Geotechnical Evaluation Report

12th Avenue North Reconstruction
Between County Road 19 and 45th Street South
West Fargo and Fargo, North Dakota
SU-8-992(036)037; PCN 20057

Prepared for

Apex Engineering Group

Professional Certification:
I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Registered Professional Engineer under the laws of the State of North Dakota.

REGISTERED PROFESSIONAL ENGINEER
EZRA BALLINGER PE 7328
DATE 10/3/2014
NORTH DAKOTA

Ezra Ballinger, PE
Associate Principal/Project Engineer
Registration Number: PE-7328
October 3, 2014

Project B14-01924

Braun Intertec Corporation

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The Science You Build On.

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October 3, 2014

Project B14-01924

Mr. Matt Kinsella
Apex Engineering Group
4733 Amber Valley Parkway South
Fargo, ND 58104

Re: Geotechnical Evaluation
12th Avenue North Reconstruction
Between County Road 19 and 45th Street South
West Fargo and Fargo, North Dakota

Dear Mr. Kinsella:

We are pleased to present this Geotechnical Evaluation Report for the proposed reconstruction of 12th Avenue Northeast at the above referenced location. The majority of the project is located within the City of West Fargo, with the eastern mile extending into the City of Fargo. The purpose of this geotechnical evaluation was to assist Apex Engineering Group (Apex) and the other project team members in designing the pavement section and providing recommendations for the project earthwork. Our results and recommendations are summarized in the attached report. We appreciate the opportunity to be of service to you on this project. If you have questions about the attached report, please contact Ezra Ballinger at 701.232.8701.

Sincerely,

BRAUN INTERTEC CORPORATION

Ezra Ballinger, PE
Associate Principal/Project Engineer

Nathan L. McKinney, PE
Principal/Senior Engineer

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Appendix

A. Introduction

A.1. Project Description

This Geotechnical Evaluation Report addresses the proposed reconstruction of an approximately 2.6 mile section of 12th Avenue North in the cities of West Fargo and Fargo. The project termini are 45th Street North on the east side and County Road 19 on the west side. The current alignment is a two lane rural roadway that will be reconstructed as a three lane modified urban section and will include a sidewalk on one or both sides depending on the location. The vertical alignment will be lowered about 1 to 4 feet at the centerline and involve fills of a few feet in the existing ditches and beneath the new sidewalks. New sanitary sewer will be constructed at a depth of about 20 to 30 feet beneath the roadway from 9th Street East to the west for about 1 ¼ miles. The scope of the project is illustrated in the Soil Boring Location Sketch attached in the Appendix to this report.

A.2. Purpose

The purpose of our geotechnical evaluation will be to characterize subsurface geologic conditions at selected exploration locations and evaluate their impact on the design and construction of the proposed improvements.

A.3. Background Information and Reference Documents

To facilitate our evaluation, we were provided with or reviewed the following information or documents:

- A figure titled *Cooperative Project Concept Report* for the 12th Avenue North CR 19 to 45th Street, provided by Matt Kinsella of Apex via email;
- Cross sections developed for the 50% design submittal for Project No. SU-8-992(036)037, Section 200, Sheets 8 to 124 printed on 7/9/2014 and provided by Matt Kinsella of Apex via email;
- Drawings titled *Drainage Layouts, 12th Avenue North, West Fargo-Fargo, Cass County, North Dakota,* Project No. SU-8-992(036)037, Section 55, Sheets 1 to 12, printed on 2/25/2014 and provided by Matt Kinsella of Apex via email;
- Aerial photography of the site available in Google Earth™ with an imagery date of 4/2014;
- The *Geologic Map of North Dakota* (L. Clayton, 1980) for aid in classification of the existing soils; and
- The *NDDOT Standard Specifications for Road and Bridge Construction,* dated 2014.

A.4. Site Conditions

The roadway currently exists as a two-lane, bituminous-surfaced, rural section roadway throughout the project area. Ditches border the roadway on the north and south sides. The ditches are relatively deep throughout the project (low points generally 5 to 10 feet below the pavement surface). The roadway crosses Cass County Drain 21 on the west end, the Sheyenne River about ½ mile east of the west end, Cass County Drain 45 near the center of the project, and the Sheyenne Diversion Tie-Back Levee about ½ mile west of the east end. The City of Fargo Landfill is located on the south side of the roadway at the east end of the project from 45th street south to the west for about ¼ mile. The pavements are generally in good condition.

A.5. Scope of Services

Our scope of services for this project was originally submitted as a Proposal to Mr. Matt Kinsella of Apex on April 28, 2014. We received authorization to proceed from Mr. Kinsella on April 29, 2014. Our scope of services was later modified to include additional exploration necessary to provide recommendations for the construction of the deep sanitary sewer which was not requested during the proposal phase of the project. Mr. Kinsella authorized the additional work on June 9, 2014. Tasks completed in accordance with our authorized scope of services are described below.

Our authorized scope of services also includes a Phase I Environmental Site Assessment (ESA) for the project and may ultimately include a Phase II ESA to evaluate contaminated soils. The results of this work will be presented in a separate report at a later date. Additionally, our authorized scope included the realignment of about 1250 feet of Cass County Road 19 at the west end of the project. The work for this roadway was subsequently requested to be presented in a separate report that will be completed and presented at a later date.

Our scope of services was performed under the terms of our Master Professional Services Agreement with Apex, dated May 24, 2013.

A.5.a. Staking and Surveying

We initially staked exploration locations at approximately 1000 foot intervals along the project length. When the additional exploration was authorized for the deep sanitary sewer we staked additional borings for that exploration. Surface elevations at the boring locations were interpolated from the project plans we have reviewed.

A.5.b. Subsurface Exploration

We performed 23 standard penetration test borings at the locations shown on the Soil Boring Location Sketch in the Appendix. The borings are numbered ST-01 through ST-15 and ST-19 through ST-25 (Borings ST-16 to ST-18 are for the realigned portion of CR 19 and will be discussed in the separate report for that project). The borings were extended to depths of 11 to 36 feet. Thin-walled tube samples were taken at various depths as selected borings were advanced. Bulk samples were also taken at selected locations.

Prior to commencing with our subsurface exploration activities, we cleared the exploration locations of underground utilities through North Dakota One Call.

A.5.c. Traffic Control

During drilling we provided signage and flagging personnel so that the borings could be safely drilled through the roadway surface while allowing traffic to continue to pass in the adjacent lane.

A.5.d. Laboratory Testing

We performed a laboratory testing program on selected penetration test, thin-walled tube, and bulk samples consisting of moisture content tests, dry density tests, organic content tests, Atterberg limit tests, percent passing the #200 sieve tests, unconfined compressive strength tests, standard Proctor tests, and California Bearing Ratio (CBR) tests.

A.5.e. Geotechnical Evaluation, Analysis and Reporting

Information obtained from the soil borings and laboratory testing was used to identify the geotechnical issues influencing design and construction, qualify the nature of their impact, and outline alternatives for their mitigation. Upon reviewing our results with Mr. Kinsella and agreeing on performance expectations for the project, we developed baseline recommendations for:

- Subgrade preparation, including excavations and ground improvement;
- Excavation dewatering;
- Selecting, placing and compacting on-site or imported earth materials;
- Designing the project pavements; and
- Providing quality control and evaluating differing site conditions during construction.

B. Results

B.1. Exploration Logs

B.1.a. Log of Boring Sheets

Log of Boring sheets for our penetration test borings are included in the Appendix. The logs identify and describe the geologic materials that were penetrated, and present the results of penetration resistance tests performed within them, laboratory tests performed on penetration test samples retrieved from them, and groundwater measurements.

Strata boundaries were inferred from changes in the penetration test samples and the auger cuttings. Because sampling was not performed continuously, the strata boundary depths are only approximate. The boundary depths likely vary away from the boring locations, and the boundaries themselves may also occur as gradual rather than abrupt transitions.

B.1.b. Geologic Origins

Geologic origins assigned to the materials shown on the logs and referenced within this report were based on: (1) a review of the background information and reference documents cited above, (2) visual classification of the various geologic material samples retrieved during the course of our subsurface exploration, (3) penetration resistance testing performed for the project, (4) laboratory test results, and (5) available common knowledge of the geologic processes and environments that have impacted the site and surrounding area in the past.

B.2. Geologic Profile

B.2.a. Bituminous Pavement

All of our borings were advanced through the pavement surface. The approximate bituminous pavement thicknesses encountered at each boring location are provided in Table 1 below.

Table 1. Existing Pavement Thickness

Boring Number	Bituminous Thickness (inches)	"Aggregate Base"[1] Thickness (inches)
ST-01	12	4
ST-02	10	--
ST-03	13	10

Boring Number	Bituminous Thickness (inches)	"Aggregate Base"[1] Thickness (inches)
ST-04	12	11
ST-05	16	--
ST-06	16	--
ST-07	12	--
ST-08	10	--
ST-09	10	2
ST-10	12	12
ST-11	10	6
ST-12	12	10
ST-13	9	10
ST-14	12	6
ST-15	11	6
ST-19	11	--
ST-20	10	7
ST-21	18	--
ST-22	11	--
ST-23	11	--
ST-24	12	5
ST-25	15	--

[1] The "Aggregate Base" layer is the granular soils identified immediately beneath the bituminous in some borings. Where this layer is not called out the drillers could not identify any "base-like" soil beneath the bituminous. Additional testing would be required to confirm that these soils meet the requirements of an NDDOT Class 5 Aggregate Base Course. These soils should not be considered for reuse as Class 5 if additional testing is not performed prior to construction.

B.2.b. Fill

Below the asphalt in all of the borings we encountered fill soils extending to depths of 4 ½ to 15 feet below grade (to the termination depth in Boring ST-06). In some of the borings as noted in Table 1 above, the upper few inches of the fill soils were granular in nature (ASTM Classification "SP-SM"). From directly beneath the bituminous section or beneath the granular fills the remaining fills

consisted of lean and fat clays with various amounts of sand within them. The clay fill soils generally were brown to black in color and contained various amounts of organics.

B.2.c. Buried Topsoil

In five of the borings (ST-01, ST-19, ST-20, ST-22, and ST-23) the fills were underlain by buried topsoil that was black in color and contained roots and organic matter. The deposits ranged from ½-foot to 2 feet thick and were composed of either lean or fat clay soils.

B.2.d. Glacial Deposits

Beneath the fill or buried topsoils, the borings generally encountered glacial lake deposits consisting of fat clay (ASTM symbol "CH") with silt lenses and laminations to the termination depth of the borings. In Boring ST-23 we encountered a layer of poorly graded sand with silt (SP-SM) glacial outwash that was about 4 feet thick and was medium dense.

Penetration resistance values recorded in the glacial lake deposits ranged from 2 to 12 blows per foot (BPF), indicating they were very soft to rather stiff. As is typical with the soils in the area, the penetration resistances generally decreased with depth.

B.2.e. Alluvium

In two of the borings (ST-19 and ST-20) we encountered alluvial soils likely deposited over time as the Sheyenne River channel has changed course. The alluvial soils consisted of lean clay (CL), sandy lean clay (CL), and silty sand (SM). The sands were fine-grained in nature. Penetration test results in the alluvial clays ranged form 4 to 6 BPF, indicating they are soft to medium in consistency. A single penetration test in the alluvial sands was 4 BPF, indicating it was very loose in consistency.

B.2.f. Groundwater

Groundwater was observed in Borings ST-20 and ST-23 at depths of 23 and 18 ½ feet during drilling and immediately after the withdrawal of the auger, corresponding to elevations 878 and 884 ½ feet (relative to National Geodetic Vertical Datum 1929). We anticipate that the groundwater near the Sheyenne River (near ST-20) will typically be near and fluctuate in unison with the water level of the Sheyenne River. In Boring ST-23, the water was noted within the layer of granular glacial outwash within the clay soil profile.

Sufficient time may not have been available for groundwater to stabilize completely in the boreholes and it is possible that groundwater would have been observed in all the borings had we been able to leave them open longer. Piezometers or monitoring wells would be required to confirm the depth of the groundwater. Based on our experience in the area, we anticipate that, seasonally, stabilized groundwater levels will be within the upper 5 to 10 feet of the ground surface.

B.3. Laboratory Test Results

B.3.a. Moisture Contents

Moisture content (MC) tests (per ASTM D2216) were performed on selected penetration test and thin-walled tube samples to aid in our classifications and estimations of the materials' engineering properties. The moisture contents for the fill soils ranged from 5 to 40 percent, with an average moisture content of about 28 percent. The moisture contents for the native soils ranged from 17 to 74 percent, with an average moisture content of about 40 percent. The results of the moisture content tests are listed in the "MC" column of the Log of Boring Sheets attached in the Appendix.

It appears that most of the samples tested in fill soils are near to above their estimated optimum moisture content (for fat clays the anticipated optimum moisture content ranges from about 22 to 27 percent). The native soils are generally above their estimated optimum moisture content.

B.3.b. Moisture Contents and Unit Weights

Unit weight tests were performed on selected thin-walled tube samples to assist in our estimation of the materials' engineering properties and aid in settlement calculations. The results of the tests indicate the materials' have wet densities (WD) ranging from 103 to 120 pounds per cubic foot (pcf); and dry densities (DD) ranging from 63 to 90 pcf. The results of the unit weight tests are listed in the "Tests or Notes" column of the Log of Boring Sheets attached in the Appendix.

B.3.c. Organic Contents

Organic content (OC) tests (per ASTM D2974) were performed on selected samples to determine the reusability of the material for structure support and pavement design. The organic contents of the materials tested ranged from 3 to 10 percent (average of 7 percent). We generally recommend materials with organic contents exceeding 5 percent not be reused as backfill below pavements. The results of the organic content tests are listed in the "Tests or Notes" column on the attached Log of Boring sheets.

B.3.d. Atterberg Limits

Two Atterberg limits tests (per ASTM D4318) were performed on selected samples for classification, evaluation of the soils' plasticity, and estimation of engineering parameters. The results of the Atterberg limits tests indicated the soils tested had liquid limits (LL) of 82 and 87 percent, plastic limits (PL) of 28 and 25 percent, and plasticity indices (PI) of 54 and 62, indicating the soils tested were fat clays and have a high potential for shrinking/swelling with changes in their moisture content. The results of the Atterberg Limits tests are listed in the "Tests or Notes" column on the attached Log of Boring sheets.

B.3.e. Percent Passing the #200 Sieve Tests

Two percent passing the #200 sieve analyses tests (P200) (per ASTM D1140) were performed to estimate the engineering properties of the granular material. The results of the P200 tests indicated the soils encountered had P200's of 6 and 40 percent, indicating the soils are classified as poorly graded sand with silt and silty sand.

B.3.f. Unconfined Compressive Strength Tests

Unconfined compressive strength (Q_u) tests (per ASTM D2166) were performed on selected thin-walled tube samples to aid in estimating the soils' undrained shear strength. The results of the tests indicated the soils had unconfined compressive strengths ranging from 720 to 1920 pounds per square foot (psf), indicating undrained shear strengths ranging from 360 to 960 psf. The results of the unconfined compressive tests are listed in the "Tests or Notes" column on the attached Log of Boring sheets and the individual test reports are also attached.

C. Basis for Recommendations

C.1. Design Details

C.1.a. Traffic Loads

The roadway is planned to have a concrete pavement section. We have been provided with daily traffic data collected by Alfred Benesch & Company (Benesch)in June 2014. The daily traffic counts are provided in Table 2.

Table 2. Traffic Types and Counts

Location	Car	Pickup/Van	Bus	Single-Unit Truck	Tractor-Trailer	Total Vehicles[2]	Total Trucks
	2[1]	3[1]	4[1]	5-7[1]	8-13[1]		
CR19 to Center	3,046	1,835	8	426	425	5,877	859
Center to 9th	2,927	1,606	8	382	412	5,432	802
East of 9th	4,031	1,984	11	502	465	7,100	978

[1] FHWA Scheme F Class
[2] Also includes motorcycles.

Benesch also provided the total vehicles to consider in 2045 (the end of the design life):

- CR 19 to Center: 10,702 total vehicles with 1,580 trucks.
- Center to 9th: 11,550 total vehicles with 1,688 trucks.
- East of 9th Street: 15,191 total vehicles with 2,093 trucks.

Based on the provided vehicle types and quantities we have calculated the following total equivalent 18-kip single axle loads (ESALs) over the design life of 30 years.

- CR 19 to Center: 4,979,000
- Center to 9th: 4,736,000
- East of 9th Street: 5,903,000

C.1.b. Sanitary Sewer

The new sanitary sewer will be constructed beneath the center of the roadway extending from a new manhole planned at Station 74+00 toward the east to Station 149+50, ending at a new manhole just west of 9th Street East. The sanitary pipe will be 24" diameter pipe with a direction of flow from the east to the west. The pipe depth ranges from about 20 to 30 feet below grade.

C.1.c. Anticipated Grade Changes

Based on the cross sections we have reviewed the vertical alignment will be lowered about 1 to 4 feet at the centerline of the roadway and involve fills of a few feet (generally less than 5 feet but up to about 10 feet at some locations) in the existing ditches and beneath the new sidewalks.

C.1.d. Precautions Regarding Changed Information

We have attempted to describe our understanding of the proposed construction to the extent it was reported to us by others. Depending on the extent of available information, assumptions may have been made based on our experience with similar projects. If we have not correctly recorded or interpreted the project details, we should be notified. New or changed information could require additional evaluation, analyses and/or recommendations.

C.2. Design and Construction Considerations

C.2.a. Existing Pavement Section

The pavement thicknesses measured in our borings are presented above in Table 1. The average bituminous thickness measured at the boring locations was 12 inches. In half of the borings we noted granular soils that appeared to be similar to aggregate base, but testing to confirm the actual material properties/classification was not a part of this scope. Where these fill soils were observed they ranged in thickness from 2 to 12 inches.

C.2.b. Pavement Subgrade Strength

We performed a total of three CBR tests at a compaction of approximately 95 percent of the soils standard Proctor maximum dry density. The CBR values reported in the tests varied from 1.7 to 4.6, with the higher values in the locations where the subgrade soils contained more sand. For our pavement section design we utilized a CBR of 2.5, which is typical of area soils with less sand that are prevalent along this alignment.

C.2.c. Pavement Subgrade Drainage

Due to the frost susceptible nature of the fat clay soils at the site, consideration should be given to ensuring that the subgrade beneath the aggregate base is crowned to drain water off of it. Water should not be allowed to pond on and infiltrate the subgrade. This will enhance subgrade drainage efforts and reduce the potential for the subgrades to become saturated and heave upon freezing; strength loss upon thawing will also be reduced.

C.2.d. Existing Fill Soils

The existing clay fill soils were tested for the presence of organics to determine their suitability for reuse as fill beneath the roadway. The results of the testing indicate that about half of the fill soils tested have organic contents exceeding 5 percent. We recommend that materials with organic contents exceeding 5 percent not be reused as backfill below pavements. As excavation is performed for the utility trenches and lowering of the roadway, the fill soils removed will need to be closely monitored and tested for organics (per ASTM D2974) to evaluate their suitability for reuse as backfill beneath the roadway.

C.2.e. Potential Environmental Contamination

The drillers noted that the fill encountered at the 10 feet depth in Boring ST-06 had a petroleum-like odor. After subsequent discussions with Apex and the project design and ownership team, additional sampling and testing will be performed in the vicinity of Boring ST-06 to evaluate the extents of the

potentially contaminated soils. The work will be performed after a Phase I ESA has been completed and the results will be presented in a separate report at a later date.

C.2.f. Inslopes

Based on our review of the preliminary cross sections the inslopes will generally be constructed at a 4:1 slope, which we understand is preferable to the design team. Based on conversations with Mr. Kinsella, and the design team we understand that a 4:1 slope will be difficult without impacting an existing wetland on the north side of the project near Station 78+00.

Boring ST-19 was performed at approximate Station 78+00 on the south side of the roadway. We performed a slope stability analysis of the proposed slope using the finite element program Geo-Slope, which is part of GeoStudio version 8.12 by Geo-Slope International. Based on the soils encountered in Boring ST-19 and the anticipated fills, it is our opinion that a 3:1 inslope will be adequate for this area from a stability standpoint. It's our understanding that the inslope will transition to a 4:1 on both the east and west sides of the wetland and therefore the 3:1 portion will be approximately 100 feet long.

C.2.g. Dewatering

The utility excavations will penetrate groundwater. Along the majority of the excavation the subgrade soils will consist of fat clays through which seepage is generally slow and dewatering can likely be performed within the excavation using sumps and pumps. However, in Borings ST-19 and ST-20 near the Sheyenne River and Boring ST-23 located just east of 9th Street, we encountered layers of sand above the bottom of the pipe elevation. Consideration should be given to dewatering these layers prior to excavating into them as water that is pumped out from within the excavation could cause the silty soils to slough into the excavation. As an alternative to dewatering prior to construction, consideration could be given to oversizing the trench to the bottom of the sand layers to allow the placement of 3 feet of compacted clay against the sand layers to slow seepage from them as the excavation extends beneath the sand.

C.2.h. Settlement

With no significant grade raises planned beneath the roadway, we anticipate settlements due to new loading will generally not be an issue. It should be noted, however, that where the deep sanitary sewer will be constructed west of 9th Street, secondary consolidation of the backfill soils may be an issue as even properly placed clay soils will experience additional settlement after construction. Compacted clay fills will generally experience secondary consolidation (post-construction settlements) on the order of 0.2 to 0.4 percent of the total backfill thickness per logarithmic cycle of time. Based on this relationship we anticipate that 25 feet of clay backfill will experience ¾ to 1 ¼ inches of settlement in the period from 10

to 100 days following fill placement, and again from 100 to 1000 days following fill placement, and again between 1000 and 10000 days following fill placement, etc. Poor or reduced compaction of the clayey backfill will exacerbate the settlement.

C.2.i. Adjacent Landfill Considerations

At the east end of the project (from about Station 178+00 to the east end of the project) the City of Fargo Landfill is located on the south side of the road. It is our understanding that the City of Fargo is concerned that the roadway construction may impact or be impacted by operations at the landfill. Based on further conversations with the City of Fargo, the design team, and Randy Hanson of Wenck Associates, Inc. (Wenck), it is our understanding that the stability of the landfill and any impacts from the roadway are being addressed by Wenck and thus are not addressed within this report.

C.2.j. Sheyenne Diversion Tie-Back Levee

At approximately Station 176+00, about ½ mile west of the east end of the project, 12th Avenue North crosses over the existing Sheyenne Diversion Tie-Back Levee. The drawings provided by Apex show that the centerline grade of the widened roadway will match the existing grades over the top of the levee, however, the widening will result in new fill being placed on the east and west sides of the levee embankment for about 100 feet north and south of the 12th Avenue North centerline. At the request of Apex, we have evaluated the levee with the addition of fill in accordance with USACE standards for seepage and stability. As a basis for our analysis we utilized Boring ST-24 performed just west of the levee, cross sections perpendicular to the levee both north and south of 12th Avenue provided by Apex, and a finite element model we have previously developed when we performed the evaluation for certification of the Sheyenne Diversion Levee in 2012. Based on our analysis, with the added fill soils, the provisions for seepage and stability of the levee according to EM 1110-2-1913 are still met.

D. Recommendations

D.1. Roadway and Utility Construction

D.1.a. Removals and Scarification

We recommend existing pavements, including the bituminous surfacing and any aggregate base materials, be removed from the current roadway alignment. Where the new roadway will extend over areas that were previously ditches, we recommend stripping existing vegetation, trees, topsoil and root zones from beneath the proposed pavement and shoulders. This removal should extend from the

proposed left grading point of intersection (PI) to the proposed right grading PI, then down and out at a 1H:1V slope to at least 3 feet below the aggregate base of the proposed pavement and shouldering.

We also recommend that materials having an organic content greater than 5 percent be removed from within 3 vertical feet of the proposed subgrade located between the shoulder lines.

Where the sanitary sewer will be installed between Stations 74+00 and 149+50, excavation depths will extend well below the organics noted in the boring logs. For these locations we recommend that the organic fill soils and any buried topsoils be stockpiled separately from the native soils encountered in the excavations as organic soils should not be used as backfill for the trench.

To the east of the sanitary sewer installation, Borings ST-10, ST-12, ST-13, and ST-14 encountered fill soils containing organics to depths exceeding 3 feet below the existing pavement surface and we anticipate that excavation for organic soils near these borings will be necessary. Excavation should also be anticipated in other areas between borings. The required depths of the subexcavations will depend upon the proposed pavement subgrade elevations and the materials encountered. Where the bottom of the subexcavation is within 2 ½ feet of the grading grade, we recommend the upper ½-foot of the bottom of the subexcavation be scarified, mixed and moistened to a moisture content between optimum and 4 percentage points over optimum, and compacted to a minimum of 95 percent of its standard Proctor maximum dry density.

D.1.b. Excavation Support

The fat clay soils on site are Type B soils under Department of Labor Occupational Safety and Health Administration (OSHA) guidelines above groundwater and Type C soils below groundwater. Open excavations that are ≤ 20 feet deep in Type C soils will need to be maintained at a slope of 1.5H:1V or shallower and in Type B soils at a slope of 1H:1V or shallower. Please note that this slope is considered a minimum. Actual soil types and slope gradients should be verified by the contractor, as slope safety is the responsibility of the contractor. A shallower gradient will likely be necessary if groundwater is seeping from the sidewalls of the excavation below the groundwater depth. Where lateral constraints will not permit open excavations, the excavations should be properly shored per OSHA guidelines.

OSHA regulations require that excavations greater than 20 feet in depth be designed by a professional engineer. This report does not constitute an excavation plan/design. However, we recommend that the contractor maintain safe construction practices during the utility construction to minimize potential for excavation problems (e.g. maintaining drainage away from the top of the excavation, keeping all soil stockpiles well away from the excavation, keeping construction equipment away from the top of the excavation, etc.).

In the event there is insufficient room to slope excavations, or if the excavations are exposed to surcharges and need to be shored, we recommend designing the shoring based on the parameters presented below in Table 3. The parameters shown in Table 3 have not been reduced by safety factors.

Saturated unit weights are recommended to account for the potential build up of hydrostatic pressure behind undrained support structures. We recommend that saturated unit weights be reduced by 62 pounds per cubic foot for strata or portions of a stratum extending below existing grades.

Table 3. Parameters for Shoring Design

Geologic Material	Saturated Unit Weight (pcf)	Long Term Design Parameters[1]		Short Term Design Parameters		K_A	K_O	K_P
		Friction Angle (deg)	Cohesion (psf)	Friction Angle (deg)	Cohesion (psf)			
Fill (CH)	115	18	0	0	850	0.53	0.69	1.89
Fat Clay (CH) above 20'	115	18	0	0	850	0.53	0.69	2.04
Fat Clay (CH) below 20'	105	15	0	0	500	0.59	0.74	1.70
Silty Sand (SM)	115	24	0	24	0	0.42	0.59	2.37

[1]For excavations open more than a few days, we recommend using **only** the long term design parameters for design.

D.1.c. Dewatering

Based on the borings, we anticipate groundwater was likely at a depth of about 10 to 15 feet below current grade at the time of our fieldwork. Along the majority of the alignment, we anticipate that seepage of groundwater into the utility trench excavations will be slow, if any at all, due to the low permeability of the fat clays. Where dewatering is necessary for the portions of the excavation in only clay, it is our opinion that it can be accomplished with sumps and pumps placed in the bottom of the excavations.

The contractor will need to pay special care as the excavation extends into the silty sand layers encountered at about 20 feet deep in the borings near the Sheyenne River and the sand layer encountered near the east end of the alignment. A contractor should review our logs to determine the most appropriate means of dewatering so the placement of utilities and backfill can be completed the dry.

D.1.d. Utility Trench Subgrades

It is our opinion the natural soils encountered in the borings will generally support the proposed utilities. We recommend utilities conduits and connections that would be sensitive to frost-related heaving be placed below the extreme frost penetration depth of 80 inches (6 ½ feet). For the deep sanitary sewer and any other utilities extending more than 10 to 15 feet below grades, we recommend

subexcavating from below the utilities a minimum of 1 foot and replacing the materials with stabilizing aggregates (such as a ¾-inch minus material) to provide stability for worker traffic and the utilities. Groundwater in clay soils, if encountered, could be pumped from the stabilizing aggregates.

D.1.e. Reuse of On-Site Materials

The existing bituminous surfacing may be recycled and mixed with imported or on-site aggregate base materials to meet the requirements for Class 5 aggregate base materials. The existing granular fills soils immediately beneath the bituminous section may also be used provided additional testing shows that it meets, or can be blended to meet, the requirements for Class 5 aggregate base.

Organic soils removed from the excavations should be segregated and stockpiled for removal from the site. These materials should not be reused as embankment fill below the roadway. These soils could be reused as topsoil, if desired, once the roadway reconstruction has been completed.

D.1.f. Pipe Bedding Material

Unless specified by the manufacturer, imported poorly graded sand soils (sands with less than 12 percent of its particles by weight passing the 200 sieve), should be used for bedding the pipes. Imported gravel or crushed stone may also be used. These soils should extend up the side of the pipe per the recommendations of the manufacturer.

D.1.g. Excavation Backfill and Additional Required Fill

The excavated materials may be reused as backfill above the bedding. Imported soils may consist of fat clays (CH) or lean clays (CL) similar to the existing soils provided they are free of organic material and debris. Topsoils or organic soils should not be reused within 3 vertical feet of pavement subgrades. We recommend the materials be placed in loose lifts not to exceed 8 inches, be moisture conditioned to within 0 to 4 percentage points above optimum, and compacted to a minimum of 95 percent. It will be imperative that the required level of compaction is achieved in all utility trenches. Poor compaction will result in future settlement beyond the secondary consolidation discussed in Section C, which can be detrimental to pavements, curbs, driveways, sidewalks, and other structures.

D.2. Pavement Section

D.2.a. Subgrade Proofroll

After utilities have been installed, the excavations backfilled, and the subgrades along the remaining portion of the roadway have been prepared as recommended in Section D.1, a proof-roll of the pavement subgrades should be performed to determine if the materials are loose, soft or weak, and in need of further stabilization, compaction or subexcavation and recompaction or replacement. A second proof-roll should be performed after the aggregate base material is in place, and prior to placing bituminous or concrete pavement.

D.2.b. Design Sections

We utilized Figure 3.1 of the AASHTO Guide for Design of Pavement Structures for calculation of the bituminous pavement thicknesses. The input parameters used in our pavement thickness calculations were:

- Reliability = 90%;
- Standard deviation = 0.35;
- ESAL's = 5 million (CR19 to Center), 4.7 million (Center to 9th) and 5.9 million (9th to 45th);
- Effective Roadbed Soil Resilient Modulus (M_R) = $CBR^{0.64}$ x 2555psi = 4590 psi, and;
- Design serviceability loss = 2.2 (Initial Serviceability = 4.2, Terminal Serviceability = 2.0).

For calculation of the rigid pavement thicknesses we utilized Figure 3.7 of the AASHTO Guide for Design of Pavement Structures. The input parameters used in our rigid pavement thickness calculations were:

- Effective modulus of subgrade reaction (k) = 100 pci;
- Mean concrete modulus of rupture = 650 psi;
- Load transfer coefficient = 3.2;
- Drainage coefficient = 0.9;
- Design serviceability loss = 2.2;
- ESALs = = 5 million (CR19 to Center), 4.7 million (Center to 9th) and 5.9 million (9th to 45th);
- Reliability = 85%; and
- Standard deviation = 0.35.

Based upon the anticipated traffic loads and subgrade parameters stated above, we recommend the pavement sections presented in Table 4.

Table 4. Recommended Standard and Heavy Duty Pavement Sections

Location	Surfacing Thickness (inches)	Aggregate Base Course (inches)
Flexible Pavement		
CR19 to Center	9	12
Center to 9th	9	12
9th to 45th	10	12
Rigid Pavement		
CR19 to Center	10	12*
Center to 9th	10	12*
9th to 45th	10 ½	12*

*It's our understanding that 12" is the required aggregate base section by the City of West Fargo. If a reduced base thickness is considered we recommend 6" as a minimum.

We also recommend the use of a geotextile separation fabric between the pavements and the clay subgrades. The intention of the geotextile separation fabric is to provide separation between the aggregate base and the clay layer in order to maintain the pavement's aggregate base thickness over the life of the pavement; and also to maintain the drainage capabilities of the aggregate base materials. The use of geotextile separation fabric is accounted for in the thickness calculations within the Drainage Coefficient.

The above pavement designs are based upon a 30-year performance life. This is the amount of time before major reconstruction is anticipated. This performance life assumes proper care, such as seal coating and crack sealing is routinely performed. The actual pavement life will vary depending on variations in weather, traffic conditions and maintenance. Other pavement design sections providing equivalent structural capacity also could be considered.

D.2.c. Materials and Compaction

We recommend specifying aggregate base meeting the requirements of the North Dakota Department of Transportation (NDDOT) Specification 816.02 for Class 5 Aggregate Base. We recommend that the bituminous wear and base courses meet the requirements of NDDOT Specification 818.02.

We recommend that the aggregate base be compacted to a minimum of 100 percent of its maximum standard Proctor dry density. We recommend that the bituminous pavement be compacted to at least 92.5 percent of the maximum theoretical density, with no individual test results less than 90 percent.

We recommend specifying concrete for pavements that has a minimum 28-day compressive strength of 4,000 psi, and a modulus of rupture (M_r) of at least 650 psi. We also recommend Type I cement meeting the requirements of ASTM C 150. We recommend specifying 5 to 8 percent entrained air for exposed concrete to provide resistance to freeze-thaw deterioration. We also recommend using a water/cement ratio of 0.45 or less for non-reinforced concrete exposed to de-icers; and a water/cement ratio of 0.40 or less for reinforced concrete exposed to de-icers.

We recommend geotextile separation fabric meet the NDDOT Specification 858 for Type S1 or S2 Separation fabrics (non-woven). Consideration could also be given to using Type R1 as it will provide some reinforcement as well as separation.

D.2.d. Subgrade Drainage

We recommend that drainage be provided for aggregate base placed over the on-site soils or similar soils. Drainage should be provided by sloping the subgrade and daylighting the aggregate base to the shoulders. Loosely placed topsoil over the aggregate slough generally will not impede the flow of water out of the aggregate base layer provided the subgrade is sloped to drain to the ditches. Water should not be allowed to infiltrate the clay subgrade but instead flow down the in-slopes and be collected and routed through the ditches and culverts on either side of the road.

D.3. Construction Quality Control

D.3.a. Excavation Observations

We recommend having a geotechnical engineer observe all excavations related to subgrade preparation and pavement construction. The purpose of the observations is to evaluate the competence of the geologic materials exposed in the excavations, and the adequacy of required excavation oversizing.

D.3.b. Materials Testing

We recommend density tests be taken in utility trench backfill at a rate of about 1 test per 100 feet of trench per 2 vertical feet in order to verify that the soils were placed and compacted according to the recommendations of this report.

We recommend Marshall tests on bituminous mixes to evaluate strength and air voids, and density tests to evaluate compaction.

We also recommend slump, air content and strength tests of Portland cement concrete.

D.3.c. Pavement Subgrade Proof-Roll

We recommend that proof-rolling of the pavement subgrades be observed by a geotechnical engineer to determine if the results of the procedure meet project specifications, or delineate the extent of additional pavement subgrade preparation work.

D.3.d. Cold Weather Precautions

If site grading and construction is anticipated during cold weather, all snow and ice should be removed from cut and fill areas prior to additional grading. No fill should be placed on frozen subgrades. No frozen soils should be used as fill.

Concrete delivered to the site should meet the temperature requirements of ASTM C 94. Concrete should not be placed on frozen subgrades. Concrete should be protected from freezing until the necessary strength is attained.

E. Procedures

E.1. Penetration Test Borings

The penetration test borings were drilled with a truck-mounted core and auger drill equipped with hollow-stem auger. The borings were performed in accordance with ASTM D 1586. Penetration test samples were taken at 2 ½- or 5-foot intervals. Actual sample intervals and corresponding depths are shown on the boring logs.

E.2. Material Classification and Testing

E.2.a. Visual and Manual Classification

The geologic materials encountered were visually and manually classified in accordance with ASTM Standard Practice D 2488. A chart explaining the classification system is attached. Samples were placed in jars or bags and returned to our facility for review and storage.

E.2.b. Laboratory Testing

The results of the laboratory tests performed on geologic material samples are noted on or follow the appropriate attached exploration logs. The tests were performed in accordance with ASTM or AASHTO procedures.

E.3. Groundwater Measurements

The drillers checked for groundwater as the penetration test borings were advanced, and again after auger withdrawal. The boreholes were then backfilled or allowed to remain open for an extended period of observation as noted on the boring logs.

F. Qualifications

F.1. Variations in Subsurface Conditions

F.1.a. Material Strata

Our evaluation, analyses and recommendations were developed from a limited amount of site and subsurface information. It is not standard engineering practice to retrieve material samples from exploration locations continuously with depth, and therefore strata boundaries and thicknesses must be inferred to some extent. Strata boundaries may also be gradual transitions, and can be expected to vary in depth, elevation and thickness away from the exploration locations.

Variations in subsurface conditions present between exploration locations may not be revealed until additional exploration work is completed, or construction commences. If any such variations are revealed, our recommendations should be re-evaluated. Such variations could increase construction costs, and a contingency should be provided to accommodate them.

F.1.b. Groundwater Levels

Groundwater measurements were made under the conditions reported herein and shown on the exploration logs, and interpreted in the text of this report. It should be noted that the observation periods were relatively short, and groundwater can be expected to fluctuate in response to rainfall, flooding, irrigation, seasonal freezing and thawing, surface drainage modifications and other seasonal and annual factors.

F.2. Continuity of Professional Responsibility

F.2.a. Plan Review

This report is based on a limited amount of information, and a number of assumptions were necessary to help us develop our recommendations. It is recommended that our firm review the geotechnical aspects

of the designs and specifications, and evaluate whether the design is as expected, if any design changes have affected the validity of our recommendations, and if our recommendations have been correctly interpreted and implemented in the designs and specifications.

F.2.b. Construction Observations and Testing

It is recommended that we be retained to perform observations and tests during construction. This will allow correlation of the subsurface conditions encountered during construction with those encountered by the borings, and provide continuity of professional responsibility.

F.3. Use of Report

This report is for the exclusive use of the parties to which it has been addressed. Without written approval, we assume no responsibility to other parties regarding this report. Our evaluation, analyses and recommendations may not be appropriate for other parties or projects.

F.4. Standard of Care

In performing its services, Braun Intertec used that degree of care and skill ordinarily exercised under similar circumstances by reputable members of its profession currently practicing in the same locality. No warranty, express or implied, is made.

Appendix

DENOTES APPROXIMATE LOCATION OF STANDARD PENETRATION TEST BORING

500' 0 1,000'

SCALE: 1" = 1,000'

BRAUN INTERTEC

11001 Hampshire Avenue So.
Minneapolis, MN 55438
PH. (952) 995-2000
FAX (952) 995-2020

SOIL BORING LOCATION SKETCH

GEOTECHNICAL EVALUATION
12th AVENUE N RECONSTRUCTION
12th AVENUE N FROM COUNTY ROAD 19 TO 45th STREET S
WEST FARGO AND FARGO, NORTH DAKOTA

Project No:	B1401924
Drawing No:	B1401924
Scale:	1" = 1,000'
Drawn By:	BJB
Date Drawn:	7/16/14
Checked By:	EB
Last Modified:	10/2/14
Sheet: of	Fig:

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BRAUN INTERTEC

LOG OF BORING

Braun Project B14-01924
Geotechnical Evaluation
12th Avenue NE Reconstruction
12th Avenue NE from CR19 to 45th St.
West Fargo, North Dakota

BORING: **ST-01**

LOCATION: 7' south of centerline. See Sketch.

DRILLER: J. Brooks | METHOD: 3 1/4" HSA, Autohammer | DATE: **4/30/14** | SCALE: **1" = 5'**

Elev. feet	Depth feet	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	qp tsf	Tests or Notes
905.0	0.0							
904.0	1.0	BIT	12 inches of Bituminous Surfacing.					
903.7	1.3	FILL	FILL: Poorly Graded Sand with Silt, trace Gravel, brown, moist.	7				
		FILL	FILL: Lean Clay, trace Sand and Gravel, black and dark gray, wet.	7		18		
901.0	4.0	FILL	FILL: Fat Clay, black and dark gray, wet.					
899.0	6.0			10		32		
898.5	6.5	CH	FAT CLAY, slightly Organic, black, wet. (Buried Topsoil)					
		CH	FAT CLAY, gray, wet, medium. (Glacial Lake Deposit)	12				
894.0	11.0			8		31	1 1/2	
			END OF BORING.					
			Water not observed with 9 1/2 feet of hollow stem auger in the ground.					
			Boring then backfilled.					

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2014\01924.GPJ BRAUN_V8_CURRENT.GDT 7/21/14 14:55

BRAUN INTERTEC

LOG OF BORING

Braun Project B14-01924
Geotechnical Evaluation
12th Avenue NE Reconstruction
12th Avenue NE from CR19 to 45th St.
West Fargo, North Dakota

BORING: **ST-02**

LOCATION: 7 1/2' south of centerline. See Sketch.

DRILLER: J. Brooks | METHOD: 3 1/4" HSA, Autohammer | DATE: **4/30/14** | SCALE: **1" = 5'**

(See Descriptive Terminology sheet for explanation of abbreviations)

Elev. feet	Depth feet	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	qp tsf	Tests or Notes
901.0	0.0							
900.2	0.8	BIT	10 inches of Bituminous Surfacing.					
		FILL	FILL: Fat Clay with Sand, trace Gravel, slightly Organic, black and brown, wet.	FA TW				
				3		33		OC=3%
894.5	6.5	CH	FAT CLAY, with Silt lenses, brown and gray, moist, rather stiff. (Glacial Lake Deposit)	9		27	1 3/4	
				8		25	3 1/2	
890.0	11.0		END OF BORING.					
			Bag sample collected from about 2 to 5 feet.					
			Water not observed with 9 1/2 feet of hollow stem auger in the ground.					
			Boring then backfilled.					

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BRAUN INTERTEC

LOG OF BORING

Braun Project B14-01924
Geotechnical Evaluation
12th Avenue NE Reconstruction
12th Avenue NE from CR19 to 45th St.
West Fargo, North Dakota

BORING: **ST-03**

LOCATION: 6' south of centerline. See Sketch.

DRILLER: J. Brooks | METHOD: 3 1/4" HSA, Autohammer | DATE: **4/30/14** | SCALE: **1" = 5'**

(See Descriptive Terminology sheet for explanation of abbreviations)

Elev. feet	Depth feet	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	Tests or Notes
901.0	0.0						
899.9	1.1	BIT	13 inches of Bituminous Surfacing.				
899.0	2.0	FILL	FILL: Poorly Graded Sand with Silt, trace Gravel, brown, moist.	FA			
		FILL	FILL: Lean Clay with Sand, gray, moist.	8		19	
894.5	6.5			7			
		FILL	FILL: Clayey Sand, fine-grained, slightly Organic, trace wood debris, gray and dark gray, wet.	7		27	
892.0	9.0	CL-ML	SILTY CLAY, gray and dark gray, wet, soft. (Glacial Lake Deposit)	3		33	
890.0	11.0		END OF BORING.				
			Water not observed with 9 1/2 feet of hollow stem auger in the ground.				
			Boring then backfilled.				

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LOG OF BORING

Braun Project B14-01924
Geotechnical Evaluation
12th Avenue NE Reconstruction
12th Avenue NE from CR19 to 45th St.
West Fargo, North Dakota

BORING: **ST-04**

LOCATION: 6 1/2' south of centerline. See Sketch.

DRILLER: J. Brooks | METHOD: 3 1/4" HSA, Autohammer | DATE: **4/30/14** | SCALE: **1" = 5'**

Elev. feet	Depth feet	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	qp tsf	Tests or Notes
901.0	0.0							
900.0	1.0	BIT	12 inches of Bituminous Surfacing.					
899.0	2.0	FILL	FILL: Poorly Graded Sand with Silt, trace Gravel, brown, moist.	FA				
897.8	3.3	FILL	FILL: Lean Clay with Sand, slightly Organic, trace Gravel, black, moist.	10				
894.5	6.5	FILL	FILL: Silty Clay, slightly Organic, black, wet.	TW				
		CH	FAT CLAY, gray, moist, rather stiff. (Glacial Lake Deposit)	9		25	1 1/2	
890.0	11.0			9		24	3 1/4	
			END OF BORING.					
			Bag sample collected from about 2 to 5 feet.					
			Water not observed with 9 1/2 feet of hollow stem auger in the ground.					
			Boring then backfilled.					

(See Descriptive Terminology sheet for explanation of abbreviations)

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BRAUN INTERTEC

LOG OF BORING

Braun Project B14-01924
Geotechnical Evaluation
12th Avenue NE Reconstruction
12th Avenue NE from CR19 to 45th St.
West Fargo, North Dakota

BORING: **ST-05**

LOCATION: 7' south of centerline. See Sketch.

DRILLER: J. Brooks | METHOD: 3 1/4" HSA, Autohammer | DATE: **5/2/14** | SCALE: **1" = 5'**

Elev. feet	Depth feet	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	qp tsf	Tests or Notes
900.0	0.0							
898.6	1.4	BIT	16 inches of Bituminous Surfacing.					
		FILL	FILL: Sandy Lean Clay, trace Gravel, slightly Organic, black, wet.	FA				
896.0	4.0			9		25		
		FILL	FILL: Fat Clay, Organic, black, wet.	10		32		OC=10%
892.3	7.8							
		CH	FAT CLAY, with Silt lenses, brown and gray with iron-staining, wet, soft. (Glacial Lake Deposit)	3		38	1/2	LL=82, PL=28, PI=54
889.0	11.0			3		43	1/2	
			END OF BORING. Water not observed with 9 1/2 feet of hollow stem auger in the ground. Boring then backfilled.					

(See Descriptive Terminology sheet for explanation of abbreviations)

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BRAUN INTERTEC

LOG OF BORING

Braun Project B14-01924
Geotechnical Evaluation
12th Avenue NE Reconstruction
12th Avenue NE from CR19 to 45th St.
West Fargo, North Dakota

BORING: **ST-06**

LOCATION: 6 1/2' south of centerline. See Sketch.

DRILLER: J. Brooks | METHOD: 3 1/4" HSA, Autohammer | DATE: **5/2/14** | SCALE: **1" = 5'**

(See Descriptive Terminology sheet for explanation of abbreviations)

Elev. feet	Depth feet	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	Tests or Notes
899.0	0.0						
897.6	1.4	BIT	16 inches of Bituminous Surfacing.				
		FILL	FILL: Fat Clay, slightly Organic, trace Gravel, brown and black, moist to wet.	FA			
				9		27	
				TW			
			-black below 7 feet.	3		32	
			-Petroleum-like odor at 9 1/2 feet.	4		32	
888.0	11.0		END OF BORING.				
			Bag sample collected from about 2 to 5 feet.				
			Water not observed with 9 1/2 feet of hollow stem auger in the ground.				
			Boring then backfilled.				

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BRAUN INTERTEC

LOG OF BORING

Braun Project B14-01924
Geotechnical Evaluation
12th Avenue NE Reconstruction
12th Avenue NE from CR19 to 45th St.
West Fargo, North Dakota

BORING: **ST-07**

LOCATION: 6' north of centerline. See Sketch.

DRILLER: J. Brooks | METHOD: 3 1/4" HSA, Autohammer | DATE: **5/1/14** | SCALE: **1" = 5'**

Elev. feet	Depth feet	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	qp tsf	Tests or Notes
899.0	0.0							
898.0	1.0	BIT	12 inches of Bituminous Surfacing.					
		FILL	FILL: Fat Clay, trace Sand and Gravel, Organic, brown and black, moist to wet.	FA				
				9		21		OC=9%
				10		35		OC=8%
892.0	7.0							
		CH	FAT CLAY, with Silt lenses and seams, brown, wet, medium. (Glacial Lake Deposit)	8		27	2	
888.0	11.0			7		32	1 1/2	
			END OF BORING. Water not observed with 9 1/2 feet of hollow stem auger in the ground. Boring then backfilled.					

(See Descriptive Terminology sheet for explanation of abbreviations)

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BRAUN INTERTEC

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Braun Project B14-01924
Geotechnical Evaluation
12th Avenue NE Reconstruction
12th Avenue NE from CR19 to 45th St.
West Fargo, North Dakota

BORING: **ST-08**

LOCATION: 6' north of centerline. See Sketch.

DRILLER: J. Brooks | METHOD: 3 1/4" HSA, Autohammer | DATE: **5/1/14** | SCALE: **1" = 5'**

Elev. feet	Depth feet	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	qp tsf	Tests or Notes
899.0	0.0							
898.1	0.9	BIT	10 inches of Bituminous Surfacing.					
		FILL	FILL: Fat Clay, trace Sand, slightly Organic, dark brown and black, moist.	FA TW				
			-wet below 4 1/2 feet.	12		30		
891.5	7.5							
		CH	FAT CLAY, with Silt lenses, brown with iron-staining, moist to wet, rather stiff. (Glacial Lake Deposit)	11		27	2 3/4	
888.0	11.0			9		32	2	
			END OF BORING.					
			Bag sample collected from about 2 to 5 feet.					
			Water not observed with 9 1/2 feet of hollow stem auger in the ground.					
			Boring then backfilled.					

(See Descriptive Terminology sheet for explanation of abbreviations)

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BRAUN INTERTEC

LOG OF BORING

Braun Project B14-01924
Geotechnical Evaluation
12th Avenue NE Reconstruction
12th Avenue NE from CR19 to 45th St.
West Fargo, North Dakota

BORING: **ST-09**

LOCATION: 6' north of centerline. See Sketch.

DRILLER: J. Brooks | METHOD: 3 1/4" HSA, Autohammer | DATE: **5/1/14** | SCALE: **1" = 5'**

(See Descriptive Terminology sheet for explanation of abbreviations)

Elev. feet	Depth feet	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	qp tsf	Tests or Notes
901.0	0.0							
900.2	0.8	BIT	10 inches of Bituminous Surfacing.					
900.1	0.9	FILL	FILL: Poorly Graded Sand with Silt, trace Gravel, brown, moist.	FA				
		FILL	FILL: Fat Clay, trace Sand and Gravel, Organic, moist.	14				
				13		28		OC=9%
893.8	7.3	CH	FAT CLAY, with Silt lenses, brown with iron-staining, moist to wet, medium to rather stiff. (Glacial Lake Deposit)	10		27	2	
890.0	11.0			7		32	2	
			END OF BORING. Water not observed with 9 1/2 feet of hollow stem auger in the ground. Boring then backfilled.					

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2014\01924.GPJ BRAUN_V8_CURRENT.GDT 7/21/14 14:57

BRAUN INTERTEC

LOG OF BORING

Braun Project B14-01924
Geotechnical Evaluation
12th Avenue NE Reconstruction
12th Avenue NE from CR19 to 45th St.
West Fargo, North Dakota

BORING: **ST-10**

LOCATION: 6 1/2' north of centerline. See Sketch.

DRILLER: J. Brooks | METHOD: 3 1/4" HSA, Autohammer | DATE: **5/1/14** | SCALE: **1" = 5'**

Elev. feet	Depth feet	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	qp tsf	Tests or Notes
903.0	0.0							
902.0	1.0	BIT	12 inches of Bituminous Surfacing.					
901.0	2.0	FILL	FILL: Poorly Graded Sand with Silt, trace Gravel, brown, moist.	FA				
		FILL	FILL: Fat Clay, Organic, brown and black, wet.	10				
				TW				
895.8	7.3	CH	FAT CLAY, with Silt seams, brown with iron-staining, moist to wet, medium. (Glacial Lake Deposit)	7		27		
892.0	11.0			7		30	2 1/4	LL=87, PL=25, PI=62
			END OF BORING. Water not observed with 9 1/2 feet of hollow stem auger in the ground. Boring then backfilled.					

(See Descriptive Terminology sheet for explanation of abbreviations)

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BRAUN INTERTEC

LOG OF BORING

Braun Project B14-01924
Geotechnical Evaluation
12th Avenue NE Reconstruction
12th Avenue NE from CR19 to 45th St.
West Fargo, North Dakota

BORING: **ST-11**

LOCATION: 6 1/2' north of centerline. See Sketch.

DRILLER: J. Brooks | METHOD: 3 1/4" HSA, Autohammer | DATE: **5/1/14** | SCALE: **1" = 5'**

Elev. feet	Depth feet	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	qp tsf	Tests or Notes
901.0	0.0							
900.2	0.8	BIT	10 inches of Bituminous Surfacing.					
899.6	1.4	FILL	FILL: Poorly Graded Sand with Silt, trace Gravel, brown, moist.	13				
		FILL	FILL: Fat Clay, trace Sand and Gravel, slightly Organic, brown, moist.	8				
895.5	5.5			9		28	2	
894.5	6.5	CH	FAT CLAY, gray, moist, rather stiff. (Glacial Lake Deposit)					
		CH	FAT CLAY, with Silt seams, brown with iron-staining, moist to wet, medium. (Glacial Lake Deposit)	6		30	1 1/4	
890.0	11.0			7		28	2 1/2	
			END OF BORING.					
			Water not observed with 9 1/2 feet of hollow stem auger in the ground.					
			Boring then backfilled.					

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2014\01924.GPJ BRAUN_V8_CURRENT.GDT 7/21/14 14:57

BRAUN INTERTEC

LOG OF BORING

Braun Project B14-01924
Geotechnical Evaluation
12th Avenue NE Reconstruction
12th Avenue NE from CR19 to 45th St.
West Fargo, North Dakota

BORING: **ST-12**

LOCATION: 6 1/2' north of centerline. See Sketch.

DRILLER: J. Brooks | METHOD: 3 1/4" HSA, Autohammer | DATE: **5/1/14** | SCALE: **1" = 5'**

Elev. feet	Depth feet	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	qp tsf	Tests or Notes
901.0	0.0							
900.0	1.0	BIT	12 inches of Bituminous Surfacing.					
899.2	1.8	FILL	FILL: Poorly Graded Sand with Silt and Gravel, brown, moist.	FA				
		FILL	FILL: Fat Clay with Sand, slightly Organic, trace Gravel, brown and black, wet.	10				
				TW				
894.5	6.5	CH	FAT CLAY, with Silt lenses, gray, moist, rather stiff. (Glacial Lake Deposit)	9		27	1 1/2	
892.0	9.0	CH	FAT CLAY, with Silt seams, brown with iron-staining, wet, medium. (Glacial Lake Deposit)	10		34	2	
890.0	11.0		END OF BORING.					

Bag sample collected from about 2 to 5 feet.

Water not observed with 9 1/2 feet of hollow stem auger in the ground.

Boring then backfilled.

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2014\01924.GPJ BRAUN_V8_CURRENT.GDT 7/21/14 14:57

BRAUN INTERTEC

LOG OF BORING

Braun Project B14-01924
Geotechnical Evaluation
12th Avenue NE Reconstruction
12th Avenue NE from CR19 to 45th St.
West Fargo, North Dakota

BORING: **ST-13**

LOCATION: 6 1/2' north of centerline. See Sketch.

DRILLER: J. Brooks | METHOD: 3 1/4" HSA, Autohammer | DATE: **5/1/14** | SCALE: **1" = 5'**

Elev. feet	Depth feet	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	qp tsf	Tests or Notes
902.0	0.0							
901.2	0.8	BIT	9 inches of Bituminous Surfacing.					
900.3	1.7	FILL	FILL: Poorly Graded Sand with Silt, trace Gravel, brown, moist.	FA				
		FILL	FILL: Fat Clay with Sand, slightly Organic, trace Gravel, black, wet.	10				
				13				
894.0	8.0			7		28		
		CH	FAT CLAY, with Silt seams, gray, moist to wet, medium. (Glacial Lake Deposit)					
891.0	11.0			8		27	3	
			END OF BORING. Water not observed with 9 1/2 feet of hollow stem auger in the ground. Boring then backfilled.					

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2014\01924.GPJ BRAUN_V8_CURRENT.GDT 7/21/14 14:58

BRAUN INTERTEC

LOG OF BORING

Braun Project B14-01924
Geotechnical Evaluation
12th Avenue NE Reconstruction
12th Avenue NE from CR19 to 45th St.
West Fargo, North Dakota

BORING: **ST-14**

LOCATION: 6' north of centerline. See Sketch.

DRILLER: J. Brooks | METHOD: 3 1/4" HSA, Autohammer | DATE: **5/1/14** | SCALE: **1" = 5'**

(See Descriptive Terminology sheet for explanation of abbreviations)

Elev. feet	Depth feet	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	qp tsf	Tests or Notes
900.0	0.0							
899.0	1.0	BIT	12 inches of Bituminous Surfacing.					
898.5	1.5	FILL	FILL: Poorly Graded Sand with Silt and Gravel, brown, moist.	FA				
		FILL	FILL: Fat Clay, Organic, trace Sand and Gravel, black, wet.	11		27		OC=7%
				TW				
893.5	6.5	CH	FAT CLAY, with Silt seams, brown with iron-staining, moist to wet, medium. (Glacial Lake Deposit)	8		27	2 1/4	
889.0	11.0			6		36	2	
			END OF BORING. Water not observed with 9 1/2 feet of hollow stem auger in the ground. Boring then backfilled.					

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BRAUN INTERTEC

LOG OF BORING

Braun Project B14-01924
Geotechnical Evaluation
12th Avenue NE Reconstruction
12th Avenue NE from CR19 to 45th St.
West Fargo, North Dakota

BORING: **ST-15**

LOCATION: 8' north of centerline. See Sketch.

DRILLER: J. Brooks | METHOD: 3 1/4" HSA, Autohammer | DATE: **5/1/14** | SCALE: **1" = 5'**

Elev. feet	Depth feet	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	qp tsf	Tests or Notes
900.0	0.0							
899.1	0.9	BIT	11 inches of Bituminous Surfacing.					
898.6	1.4	FILL	FILL: Poorly Graded Sand with Silt, trace Gravel, brown, moist.	FA				
		FILL	FILL: Fat Clay, trace Sand and Gravel, slightly Organic, gray and black, moist.	11				
				16		20		OC=5%
892.8	7.3	CH	FAT CLAY, with Silt seams, brown with iron-staining, wet, medium. (Glacial Lake Deposit)	7		32	2 1/2	
889.0	11.0			6		39	1 3/4	
			END OF BORING. Water not observed with 9 1/2 feet of hollow stem auger in the ground. Boring then backfilled.					

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2014\01924.GPJ BRAUN_V8_CURRENT.GDT 7/21/14 14:58

BRAUN INTERTEC

LOG OF BORING

Braun Project B14-01924
Geotechnical Evaluation
12th Avenue NE Reconstruction
12th Avenue NE from CR19 to 45th St.
West Fargo, North Dakota

BORING: **ST-19**

LOCATION: See Sketch.

DRILLER: K. Miller | METHOD: 3 1/4" HSA, Autohammer | DATE: **6/16/14** | SCALE: **1" = 5'**

(See Descriptive Terminology sheet for explanation of abbreviations)

Elev. feet	Depth feet	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	qp tsf	Tests or Notes
901.0	0.0							
900.0	1.0	BIT	11 1/2 inches of Bituminous Surfacing.					
		FILL	FILL: Fat Clay, slightly Organic, gray and brown, moist.	FA				
			-LEAN CLAY layer at 2 1/2 feet.	9				
			-with Sand at 5 feet.	4				
				10		35		
891.0	10.0	CL	LEAN CLAY, with roots, slightly Organic, black, moist. (Buried Topsoil)	8				
889.0	12.0	SM	SILTY SAND, fine-grained, with Fat Clay lenses, gray, waterbearing, very loose. (Alluvium)	4				
				TW*		32		*Thin Wall attempted, No Recovery. P200=40%
883.0	18.0	CH	FAT CLAY, with Silt lenses and laminations, gray and brown with iron-staining, wet, rather soft. (Glacial Lake Deposit)	4		34	1	
				4			1 1/4	
				TW		34	1 1/4	MC=34%, Qu=1270 psf; WD=120 pcf, DD=90 pcf
865.0	36.0			4		53	3/4	
			END OF BORING. Water not observed with 34 1/2 feet of hollow stem auger in the ground. Boring then backfilled.					

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2014\01924.GPJ BRAUN_V8_CURRENT.GDT 7/21/14 14:59

BRAUN INTERTEC

LOG OF BORING

Braun Project B14-01924
Geotechnical Evaluation
12th Avenue NE Reconstruction
12th Avenue NE from CR19 to 45th St.
West Fargo, North Dakota

BORING: **ST-20**

LOCATION: See Sketch.

DRILLER: K. Miller | METHOD: 3 1/4" HSA, Autohammer | DATE: **6/16/14** | SCALE: **1" = 5'**

(See Descriptive Terminology sheet for explanation of abbreviations)

Elev. feet	Depth feet	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	qp tsf	Tests or Notes
901.0	0.0							
900.1	0.9	BIT	10 1/2 inches of Bituminous Surfacing.					
899.5	1.5	FILL	FILL: Poorly Graded Sand with Silt and Gravel, brown, moist.	FA				
		FILL	FILL: Clayey Sand with Gravel, brown, moist.	29				
				28		5		
892.5	8.5			6				
		FILL	FILL: Lean Clay with Sand, trace Gravel, brown, moist.	10		16		
889.0	12.0							
		CL	LEAN CLAY, with Organics, gray and black, moist. (Buried Topsoil)	10				
887.0	14.0							
		CL	LEAN CLAY, with Silt lenses, gray, moist, medium. (Alluvium)	6		22	1 1/2	
881.0	20.0			TW				
		SM	SILTY SAND, fine-grained, gray, wet. (Alluvium)		▽			
878.0	23.0							
		CL	SANDY LEAN CLAY, gray, wet, rather soft. (Alluvium)	5		17		
873.0	28.0							
		CH	FAT CLAY, gray, wet, soft. (Glacial Lake Deposit)	3			1/4	
				TW		64		MC=64%, Qu=720 psf; WD=106 pcf, DD=65 pcf
864.5	36.5							
			END OF BORING.					
			Water observed at a depth of 23 feet with 24 1/2 feet of hollow-stem auger in the ground.					

BRAUN INTERTEC

LOG OF BORING

Braun Project B14-01924
Geotechnical Evaluation
12th Avenue NE Reconstruction
12th Avenue NE from CR19 to 45th St.
West Fargo, North Dakota

BORING: **ST-20 (cont.)**
LOCATION: See Sketch.

DRILLER: K. Miller | METHOD: 3 1/4" HSA, Autohammer | DATE: **6/16/14** | SCALE: **1" = 5'**

Elev. feet 861.0	Depth feet 40.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	qp tsf	Tests or Notes
			Water observed at a depth of 29 feet with 34 1/2 feet of hollow-stem auger in the ground. Boring then backfilled.					

(See Descriptive Terminology sheet for explanation of abbreviations)

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BRAUN INTERTEC

LOG OF BORING

Braun Project B14-01924
Geotechnical Evaluation
12th Avenue NE Reconstruction
12th Avenue NE from CR19 to 45th St.
West Fargo, North Dakota

BORING: **ST-21**

LOCATION: See Sketch.

DRILLER: K. Miller | METHOD: 3 1/4" HSA, Autohammer | DATE: **6/16/14** | SCALE: **1" = 5'**

(See Descriptive Terminology sheet for explanation of abbreviations)

Elev. feet	Depth feet	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	qp tsf	Tests or Notes
900.0	0.0							
898.5	1.5	BIT	18 inches of Bituminous Surfacing.					
		FILL	FILL: Fat Clay with Sand, slightly Organic, gray and brown, moist. -black at 2 1/2 feet.	FA 12 7 3		36		
891.0	9.0	FILL	FILL: Fat Clay, gray and brown, wet.	3 3		37		
885.0	15.0	CH	FAT CLAY, with Silt lenses and laminations, brown, wet, rather soft. (Glacial Lake Deposit)	4			1 1/4	
877.0	23.0			TW		55	1	MC=55%, Qu=1750 psf; WD=106 pcf, DD=68 pcf
		CH	FAT CLAY, gray, wet, soft to rather soft. (Glacial Lake Deposit)	4 3		60 61	3/4 1//2	
864.0	36.0			2		61	1/2	
			END OF BORING. Water not observed with 34 1/2 feet of hollow stem auger in the ground. Boring then backfilled.					

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BRAUN INTERTEC

LOG OF BORING

Braun Project B14-01924
Geotechnical Evaluation
12th Avenue NE Reconstruction
12th Avenue NE from CR19 to 45th St.
West Fargo, North Dakota

BORING: **ST-22**

LOCATION: See Sketch.

DRILLER: K. Miller | METHOD: 3 1/4" HSA, Autohammer | DATE: **6/16/14** | SCALE: **1" = 5'**

(See Descriptive Terminology sheet for explanation of abbreviations)

Elev. feet	Depth feet	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	qp tsf	Tests or Notes
899.0	0.0							
898.0	1.0	BIT	11 1/2 inches of Bituminous Surfacing.					
		FILL	FILL: Fat Clay with Sand, slightly Organic, brown and black, moist.	FA				
				13		30		
894.0	5.0							
893.0	6.0	CH	FAT CLAY, slighlty Organic, black, moist. (Buried Topsoil)	11				
		CH	FAT CLAY, brown with trace iron-staining, moist to wet, medium to rather stiff. (Glacial Lake Deposit)					
				9		27	2 3/4	
			-gray at 7 1/2 feet.					
				10			2 3/4	
			-with Silt lenses and laminations at 12 1/2 feet.	6			1 3/4	
				TW		40	3/4	MC=40%, Qu=1920 psf; WD=114 pcf, DD=82 pcf
				6		55	1 3/4	
876.0	23.0							
		CH	FAT CLAY, gray, wet, soft. (Glacial Lake Deposit)					
				3		62	3/4	
868.0	31.0			2		68	1/2	
			END OF BORING.					
			Water not observed with 29 1/2 feet of hollow stem auger in the ground.					
			Boring then backfilled.					

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2014\01924.GPJ BRAUN_V8_CURRENT.GDT 7/21/14 15:00

BRAUN INTERTEC

LOG OF BORING

Braun Project B14-01924
Geotechnical Evaluation
12th Avenue NE Reconstruction
12th Avenue NE from CR19 to 45th St.
West Fargo, North Dakota

BORING: **ST-23**

LOCATION: See Sketch.

DRILLER: K. Miller | METHOD: 3 1/4" HSA, Autohammer | DATE: **6/16/14** | SCALE: **1" = 5'**

(See Descriptive Terminology sheet for explanation of abbreviations)

Elev. feet	Depth feet	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	qp tsf	Tests or Notes
903.0	0.0							
902.0	1.0	BIT	11 1/2 inches of Bituminous Surfacing.					
		FILL	FILL: Fat Clay with Sand, slightly Organic, gray and black, moist.	FA				
				11				
898.5	4.5							
		CH	FAT CLAY, slightly Organic, black, moist. (Buried Topsoil)	11				
896.5	6.5							
		CH	FAT CLAY, with Silt lenses and laminations, brown with trace iron-staining, moist to wet, rather soft to rather stiff. (Glacial Lake Deposit)	9		32	2 1/2	
				8			3	
				5		40	1 1/2	
				5			1 1/2	
885.0	18.0							
		SP-SM	POORLY GRADED SAND with SILT, fine-grained, brown, waterbearing, medium dense. (Glacial Outwash)		▽			
				27		27		P200=6%
880.5	22.5							
		CH	FAT CLAY, gray, wet. (Glacial Lake Deposit)	7		46	1 3/4	
				TW		66	1/2	
871.5	31.5							
			END OF BORING. Water observed at a depth of 18 1/2 feet with 29 1/2 feet of hollow-stem auger in the ground. Boring then backfilled.					

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2014\01924.GPJ BRAUN_V8_CURRENT.GDT 7/21/14 15:01

BRAUN INTERTEC

LOG OF BORING

Braun Project B14-01924
Geotechnical Evaluation
12th Avenue NE Reconstruction
12th Avenue NE from CR19 to 45th St.
West Fargo, North Dakota

BORING: **ST-24**

LOCATION: See Sketch.

DRILLER: K. Miller | METHOD: 3 1/4" HSA, Autohammer | DATE: **6/17/14** | SCALE: **1" = 5'**

(See Descriptive Terminology sheet for explanation of abbreviations)

Elev. feet	Depth feet	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	qp tsf	Tests or Notes
901.0	0.0							
900.0	1.0	BIT	12 1/2 inches of Bituminous Surfacing.					
899.6	1.4	FILL	FILL: Poorly Graded Sand with Silt and Gravel, brown, moist.	FA				
		FILL	FILL: Fat Clay with Sand, slightly Organic, black and gray, wet.	14				
				10		36		
893.5	7.5	CH	FAT CLAY, with Silt lenses and laminations, brown, wet, soft to medium. (Glacial Lake Deposit)	8				
				7		41	1 3/4	
				3			1	
				3		52	3/4	
880.5	20.5		-lenses of Sand at 20 feet.	5		49	1 1/2	
		CH	FAT CLAY, gray, wet, soft. (Glacial Lake Deposit)					
				TW		58	1 1/2	MC=58%, Qu=1100 psf; WD=103 pcf, DD=65 pcf
870.0	31.0			2		71	1/4	
			END OF BORING. Water not observed with 29 1/2 feet of hollow stem auger in the ground. Boring then backfilled.					

BRAUN INTERTEC

LOG OF BORING

Braun Project B14-01924
Geotechnical Evaluation
12th Avenue NE Reconstruction
12th Avenue NE from CR19 to 45th St.
West Fargo, North Dakota

BORING: **ST-25**

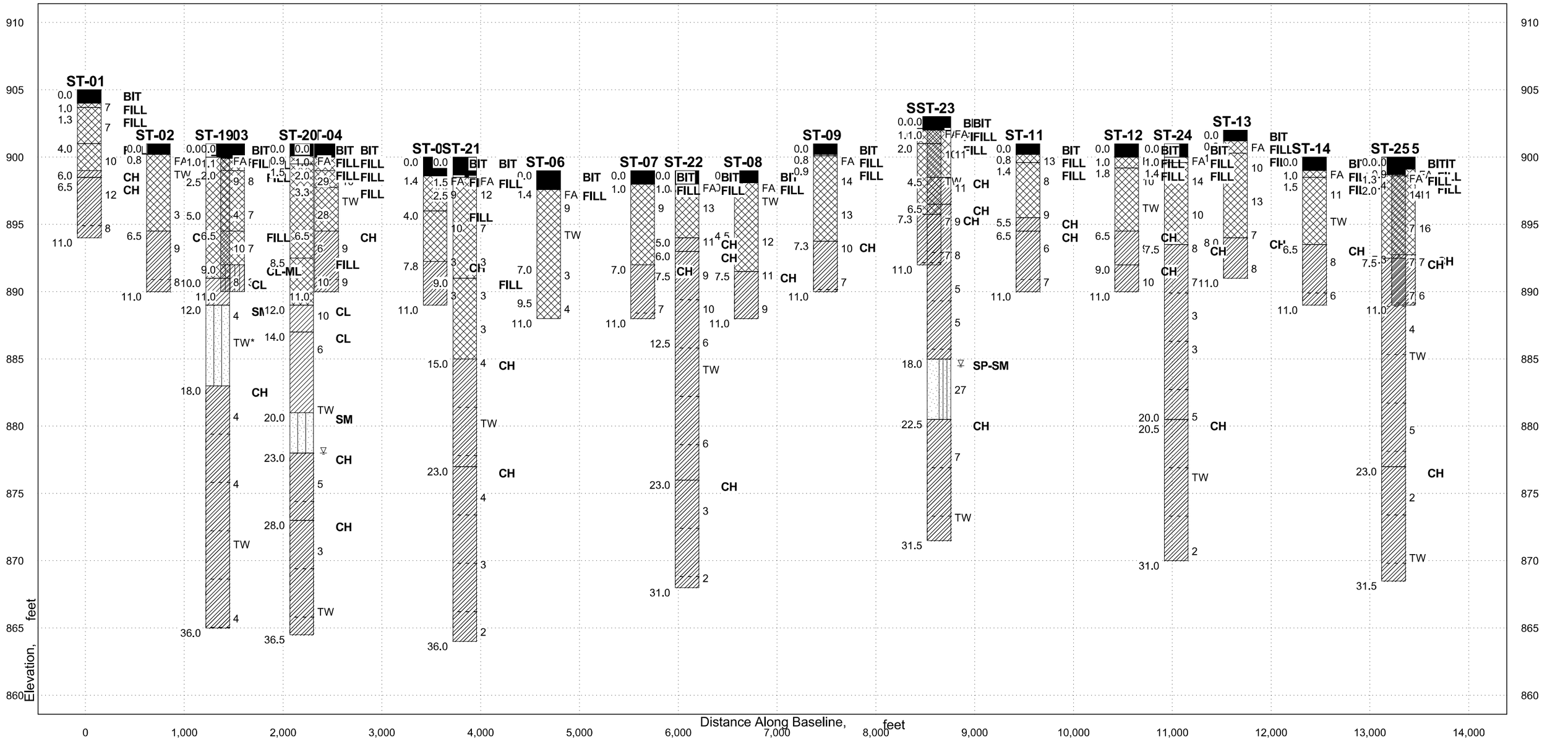
LOCATION: See Sketch.

DRILLER: K. Miller | METHOD: 3 1/4" HSA, Autohammer | DATE: **6/17/14** | SCALE: **1" = 5'**

(See Descriptive Terminology sheet for explanation of abbreviations)

Elev. feet	Depth feet	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	qp tsf	Tests or Notes
900.0	0.0							
898.7	1.3	BIT	15 inches of Bituminous Surfacing.					
		FILL	FILL: Fat Clay, slightly Organic, black, wet. -Sandy at 2 feet.	FA				
				14				
				7		40		
892.5	7.5	CH	FAT CLAY, with Silt lenses and laminations, gray and brown with trace iron-staining, wet, rather soft to medium.	7			2 1/2	
			(Glacial Lake Deposit)	7		37	2	
				4			1	
				TW		46	1 1/4	MC=46%, Qu=1490 psf; WD=110 pcf, DD=76 pcf
				5		42	2 1/4	
877.0	23.0	CH	FAT CLAY, gray, wet, soft. (Glacial Lake Deposit)					
				2		74	1/2	
				TW		64	1/4	MC=64%, Qu=1010 psf; WD=103 pcf, DD=63 pcf
868.5	31.5		END OF BORING. Water not observed with 29 1/2 feet of hollow stem auger in the ground. Boring then backfilled.					

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2014\01924.GPJ BRAUN_V8_CURRENT.GDT 7/21/14 15:02



BRAUN INTERTEC

Intertec Corporation

West to East

LITHOLOGY GRAPHICS

BIT | FILL | CH | CL-ML | CL

SM | SP-SM

12th Avenue NE Reconstruction
12th Avenue NE from CR19 to 45th St.

Project Number: B14-01924

Braun Intertec Corporation
11001 Hampshire Avenue South
Minneapolis, MN 55438
Phone: 952.995.2000

Proctor Report

Report No: PTR:W14-001783-S1
Issue No: 1

Client: Matthew Kinsella
Apex Engineering Group, Inc.
4733 Amber Valley Pkwy S
Fargo, ND, 58104

Project: B14-01924
12th Avenue NE Reconstruction
12th Avenue NE from CR19 to 45th St.
West Fargo, ND, 58078

TR: Jennifer McKinnon, jmckinnon@braunintertec.com

Laboratory Results Reviewed by:

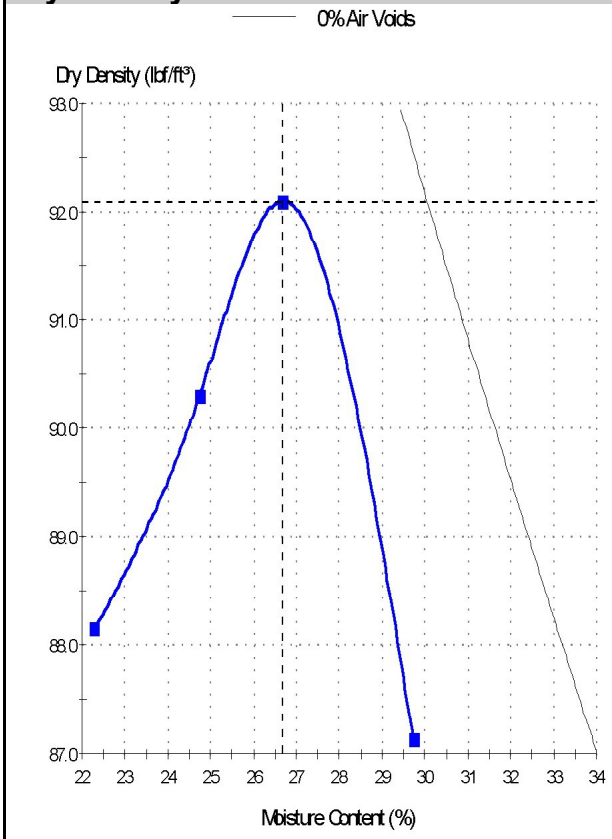
ISO/IEC 17025

Dallas Miner
Laboratory Supervisor
Date of Issue: 7/21/2014

Sample Details

Sample ID:	W14-001783-S1	**Alternate Sample ID:**	1
Date Sampled:	4/30/2014	**Date Submitted:**	5/19/2014
Sampled By:	John Brooks	**Sampling Method:**	Soil Boring Auger
Source:	Onsite material		
Material:	Fat Clay with Sand		
Specification:	For Informational Purposes Only		
Location:	Boring #2, Depth 2'-5'		
Date Tested:	5/22/2014		

Dry Density - Moisture Content Relationship



Test Results

ASTM D 698 - 07

Maximum Dry Density (lbf/ft³):	**92.1**
Corrected Maximum Dry Density (lbf/ft³):	**92.1**
Optimum Moisture Content (%):	**26.7**
Corrected Optimum Moisture Content (%):	**26.7**
Method:	A
Preparation Method:	Moist
Rammer Type:	Hand round
Specific Gravity (Fines):	2.65
Specific Gravity Method:	Assumed
Retained Sieve No 4 (4.75mm) (%):	1
Passing Sieve No 4 (4.75mm) (%):	99
Visual Description:	CH Fat Clay with Sand, brown

Comments

The 200 wash value equals 85%.

Braun Intertec Corporation
11001 Hampshire Avenue South
Minneapolis, MN 55438
Phone: 952.995.2000

Proctor Report

Report No: PTR:W14-001783-S3
Issue No: 1

Client: Matthew Kinsella
Apex Engineering Group, Inc.
4733 Amber Valley Pkwy S
Fargo, ND, 58104

Project: B14-01924
12th Avenue NE Reconstruction
12th Avenue NE from CR19 to 45th St.
West Fargo, ND, 58078

TR: Jennifer McKinnon, jmckinnon@braunintertec.com

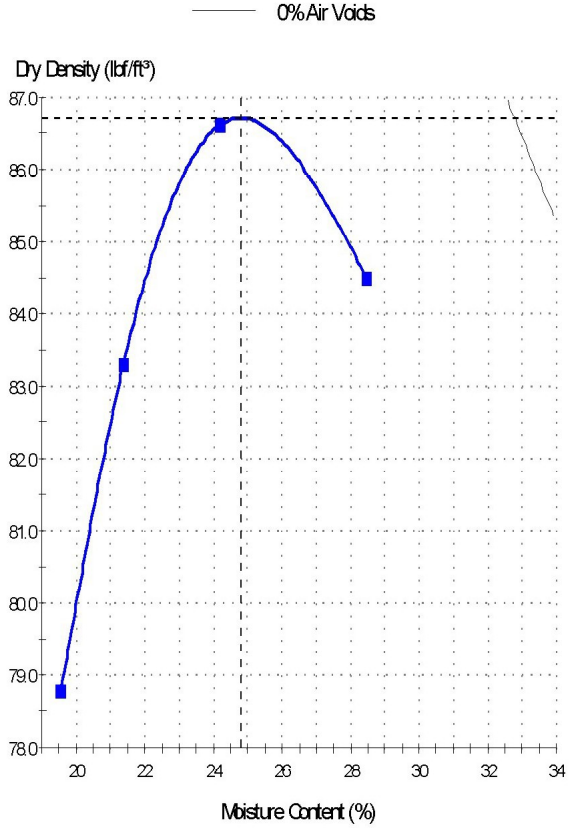
Laboratory Results Reviewed by:

Dallas Miner
Laboratory Supervisor
Date of Issue: 7/21/2014

Sample Details

Sample ID:	W14-001783-S3	**Alternate Sample ID:**	3
Date Sampled:	5/1/2014	**Date Submitted:**	5/19/2014
Sampled By:	John Brooks	**Sampling Method:**	Soil Boring Auger
Source:	Onsite material		
Material:	Fat Clay		
Specification:	For Informational Purposes Only		
Location:	Boring #8, Depth 2'-5'		
Date Tested:	5/22/2014		

Dry Density - Moisture Content Relationship



Test Results

ASTM D 698 - 07

Maximum Dry Density (lbf/ft³):	**86.7**
Corrected Maximum Dry Density (lbf/ft³):	**86.7**
Optimum Moisture Content (%):	**24.8**
Corrected Optimum Moisture Content (%):	**24.8**
Method:	A
Preparation Method:	Moist
Rammer Type:	Hand round
Specific Gravity (Fines):	2.55
Specific Gravity Method:	Assumed
Retained Sieve No 4 (4.75mm) (%):	3
Passing Sieve No 4 (4.75mm) (%):	97
Visual Description:	CH Fat Clay, dark brown

Comments

The 200 wash value equals 96%

Braun Intertec Corporation
11001 Hampshire Avenue South
Minneapolis, MN 55438
Phone: 952.995.2000

Proctor Report

Report No: PTR:W14-001783-S2
Issue No: 1

Client: Matthew Kinsella
Apex Engineering Group, Inc.
4733 Amber Valley Pkwy S
Fargo, ND, 58104

Project: B14-01924
12th Avenue NE Reconstruction
12th Avenue NE from CR19 to 45th St.
West Fargo, ND, 58078

TR: Jennifer McKinnon, jmckinnon@braunintertec.com

Laboratory Results Reviewed by:

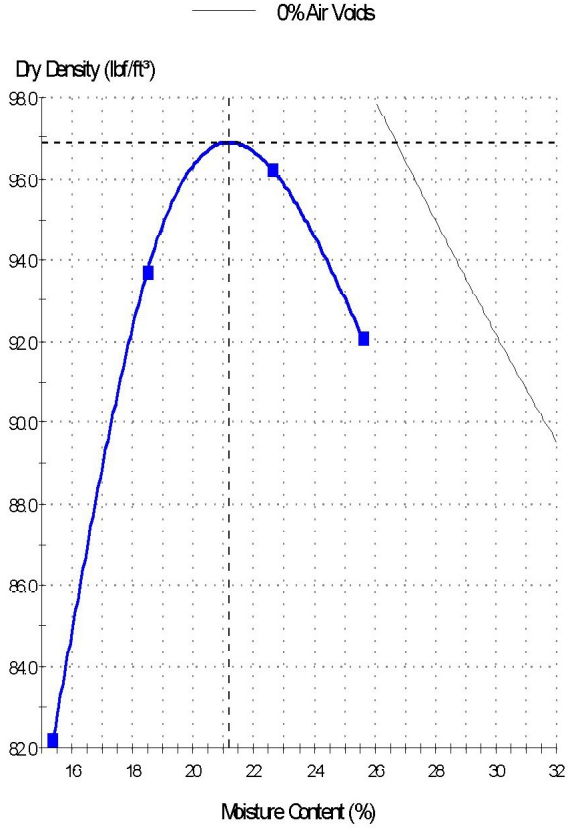
ISO/IEC 17025

Dallas Miner
Laboratory Supervisor
Date of Issue: 7/21/2014

Sample Details

Sample ID:	W14-001783-S2	**Alternate Sample ID:**	2
Date Sampled:	5/1/2014	**Date Submitted:**	5/19/2014
Sampled By:	John Brooks	**Sampling Method:**	Soil Boring Auger
Source:	Onsite material		
Material:	Fat Clay with Sand		
Specification:	For Informational Purposes Only		
Location:	Boring #12, Depth 2'-4'		
Date Tested:	5/22/2014		

Dry Density - Moisture Content Relationship



Test Results

ASTM D 698 - 07

Maximum Dry Density (lbf/ft³):	**96.9**
Corrected Maximum Dry Density (lbf/ft³):	**96.9**
Optimum Moisture Content (%):	**21.2**
Corrected Optimum Moisture Content (%):	**21.2**
Method:	A
Preparation Method:	Moist
Rammer Type:	Hand round
Specific Gravity (Fines):	2.65
Specific Gravity Method:	Assumed
Retained Sieve No 4 (4.75mm) (%):	6
Passing Sieve No 4 (4.75mm) (%):	94
Visual Description:	CH Fat Clay with Sand, brown

Comments

The 200 wash value equals 76%

Braun Intertec Corporation
11001 Hampshire Avenue South
Minneapolis, MN 55438
Phone: 952.995.2000

California Bearing Ratio Test Report

Report No: CBR:W14-001783-S1
Issue No: 1

Client: Matthew Kinsella
Apex Engineering Group, Inc.
4733 Amber Valley Pkwy S
Fargo, ND, 58104

Project: B14-01924
12th Avenue NE Reconstruction
12th Avenue NE from CR19 to 45th St.
West Fargo, ND, 58078

TR: Jennifer McKinnon, jmckinnon@braunintertec.com

Laboratory Results Reviewed by:

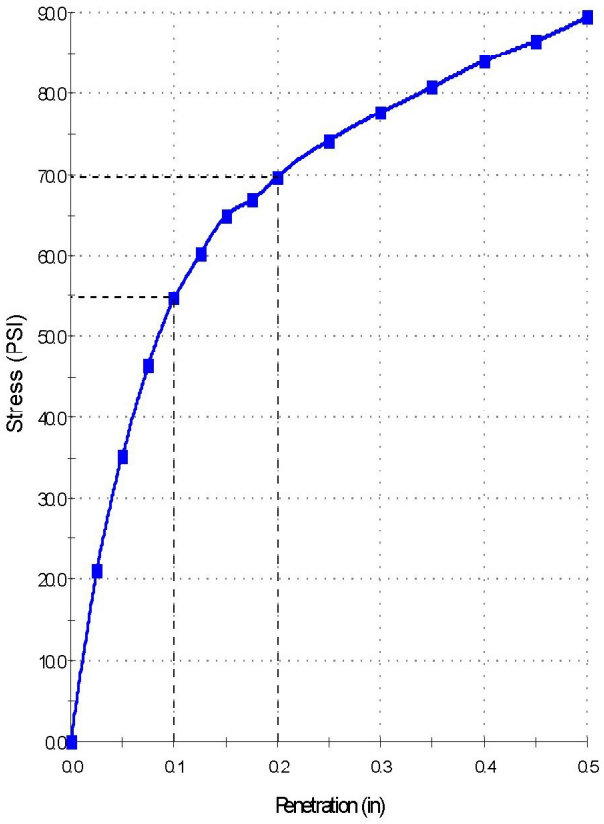
ISO/IEC 17025

Dallas Miner
Laboratory Supervisor
Date of Issue: 7/21/2014

Sample Details

Sample ID:	W14-001783-S1	**Alternate Sample ID:**	1
Sampled By:	John Brooks	**Date Sampled:**	4/30/2014
Sampling Method:	Soil Boring Auger	**Source:**	Onsite material
Material:	Fat Clay with Sand	**Specification:**	For Informational Purposes Only
Sample Location:	Boring #2, Depth 2'-5'		

Stress vs Penetration



Test Results

ASTM D 1883 - 07

CBR At 0.1in (%):	5.5
CBR At 0.2in (%):	4.6
Compactive Effort:	ASTM D 698
Number of Blows:	56
% of Maximum Dry Density:	95.6
Dry Density Before Soaking (lb/ft³):	88.1
MC Before Compaction (%):	27.2
MC After Compaction (%):	27.1
Moisture Content of Top 1in (%):	31.1
Average Moisture Content (%):	
Maximum Dry Density (lb/ft³):	92.1
Optimum Moisture Content (%):	26.7
Sample Condition:	soaked
Swell (%):	1.3
Surcharge Mass (lb):	10.00
Oversize Material (%):	0.0
Date Tested:	5/27/2014

Comments

Braun Intertec Corporation
11001 Hampshire Avenue South
Minneapolis, MN 55438
Phone: 952.995.2000

California Bearing Ratio Test Report

Report No: CBR:W14-001783-S3
Issue No: 1

Client: Matthew Kinsella
Apex Engineering Group, Inc.
4733 Amber Valley Pkwy S
Fargo, ND, 58104

Project: B14-01924
12th Avenue NE Reconstruction
12th Avenue NE from CR19 to 45th St.
West Fargo, ND, 58078

TR: Jennifer McKinnon, jmckinnon@braunintertec.com

Laboratory Results Reviewed by:

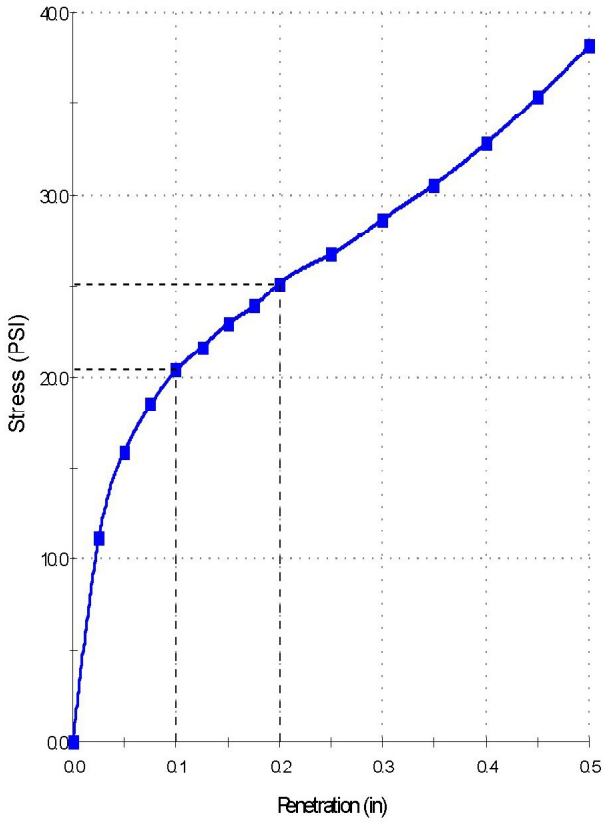
ISO/IEC 17025

Dallas Miner
Laboratory Supervisor
Date of Issue: 7/21/2014

Sample Details

Sample ID:	W14-001783-S3	**Alternate Sample ID:**	3
Sampled By:	John Brooks	**Date Sampled:**	5/1/2014
Sampling Method:	Soil Boring Auger	**Source:**	Onsite material
Material:	Fat Clay	**Specification:**	For Informational Purposes Only
Sample Location:	Boring #8, Depth 2'-5'		

Stress vs Penetration



Test Results

ASTM D 1883 - 07

CBR At 0.1in (%):	2.0
CBR At 0.2in (%):	1.7
Compactive Effort:	ASTM D 698
Number of Blows:	56
% of Maximum Dry Density:	94.7
Dry Density Before Soaking (lb/ft³):	82.1
MC Before Compaction (%):	25.3
MC After Compaction (%):	25.2
Moisture Content of Top 1in (%):	41.7
Average Moisture Content (%):	
Maximum Dry Density (lb/ft³):	86.7
Optimum Moisture Content (%):	24.8
Sample Condition:	soaked
Swell (%):	4.4
Surcharge Mass (lb):	10.00
Oversize Material (%):	0.0
Date Tested:	5/27/2014

Comments

Braun Intertec Corporation
11001 Hampshire Avenue South
Minneapolis, MN 55438
Phone: 952.995.2000

California Bearing Ratio Test Report

Report No: CBR:W14-001783-S2
Issue No: 1

Client: Matthew Kinsella
Apex Engineering Group, Inc.
4733 Amber Valley Pkwy S
Fargo, ND, 58104

Project: B14-01924
12th Avenue NE Reconstruction
12th Avenue NE from CR19 to 45th St.
West Fargo, ND, 58078

TR: Jennifer McKinnon, jmckinnon@braunintertec.com

Laboratory Results Reviewed by:

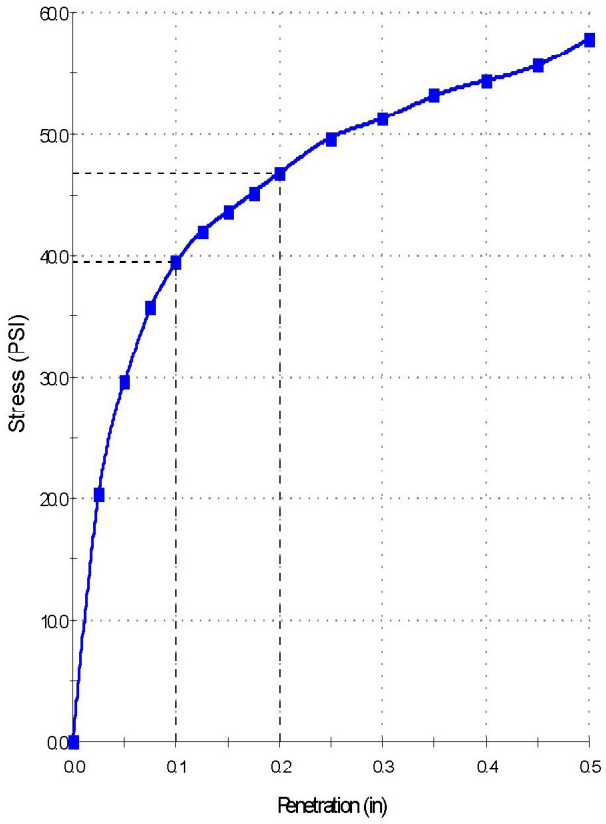
ISO/IEC 17025

Dallas Miner
Laboratory Supervisor
Date of Issue: 7/21/2014

Sample Details

Sample ID:	W14-001783-S2	**Alternate Sample ID:**	2
Sampled By:	John Brooks	**Date Sampled:**	5/1/2014
Sampling Method:	Soil Boring Auger	**Source:**	Onsite material
Material:	Fat Clay with Sand	**Specification:**	For Informational Purposes Only
Sample Location:	Boring #12, Depth 2'-4'		

Stress vs Penetration

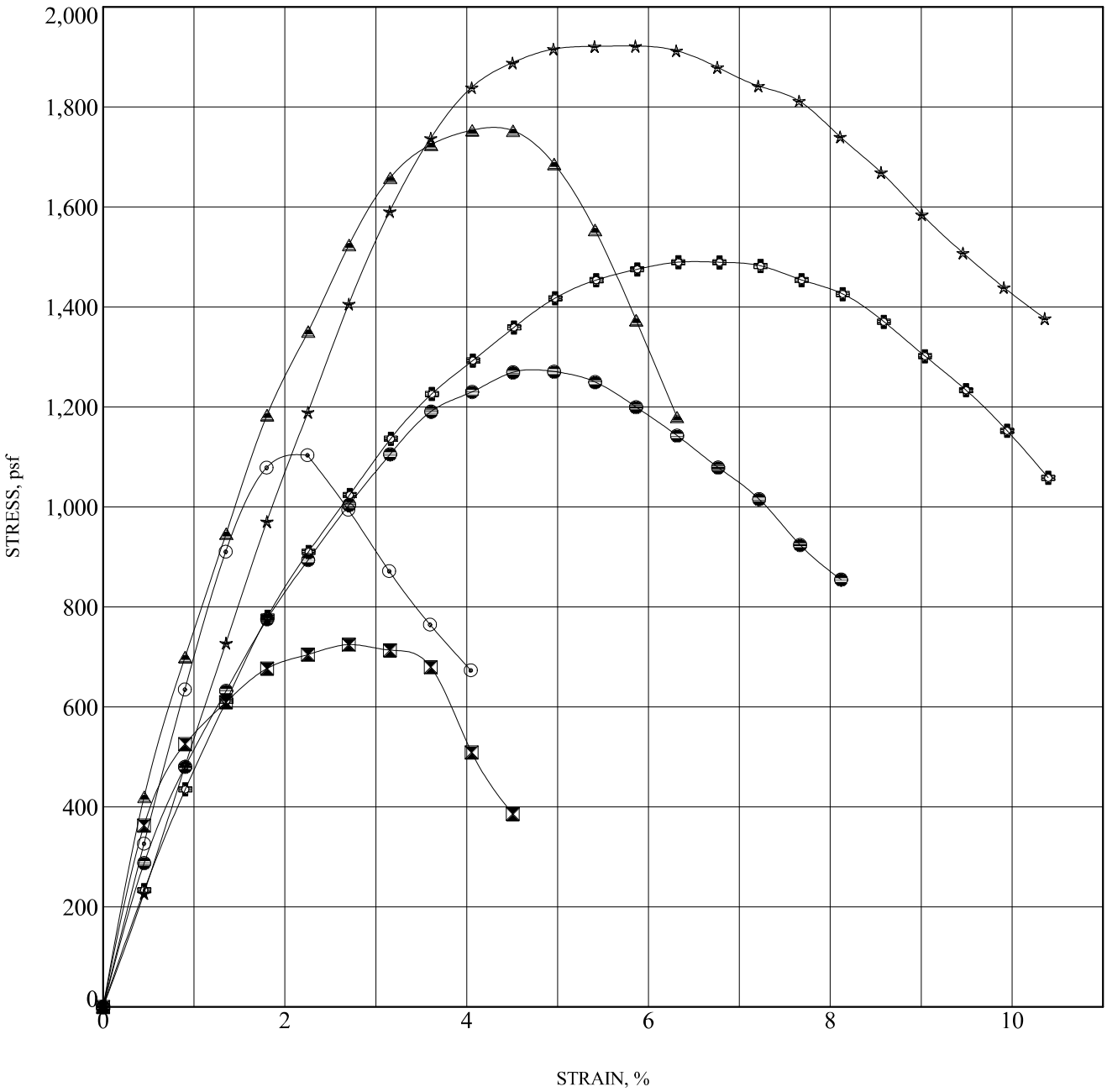


Test Results

ASTM D 1883 - 07

CBR At 0.1in (%):	3.9
CBR At 0.2in (%):	3.1
Compactive Effort:	ASTM D 698
Number of Blows:	50
% of Maximum Dry Density:	95.0
Dry Density Before Soaking (lb/ft³):	92.0
MC Before Compaction (%):	21.7
MC After Compaction (%):	21.7
Moisture Content of Top 1in (%):	28.4
Average Moisture Content (%):	
Maximum Dry Density (lb/ft³):	96.9
Optimum Moisture Content (%):	21.2
Sample Condition:	soaked
Swell (%):	1.9
Surcharge Mass (lb):	10.00
Oversize Material (%):	0.0
Date Tested:	5/27/2014

Comments



Specimen Identification			Classification	γ_d	MC%	Strength	Strain
ST-19	29.5'-31.5'		FAT CLAY (CH)	90	34	1270	5.0
ST-20	34.5'-36.5'		FAT CLAY (CH)	65	64	725	2.7
ST-21	19.5'-21.5'		FAT CLAY (CH)	68	55	1750	4.1
ST-22	14.5'-16.5'		FAT CLAY (CH)	82	40	1920	5.9
ST-24	24.5'-26.5'		FAT CLAY (CH)	65	58	1100	2.2
ST-25	14.5'-16.5'		FAT CLAY (CH)	76	46	1490	6.3

Braun Project B14-01924
Geotechnical Evaluation
12th Avenue NE Reconstruction
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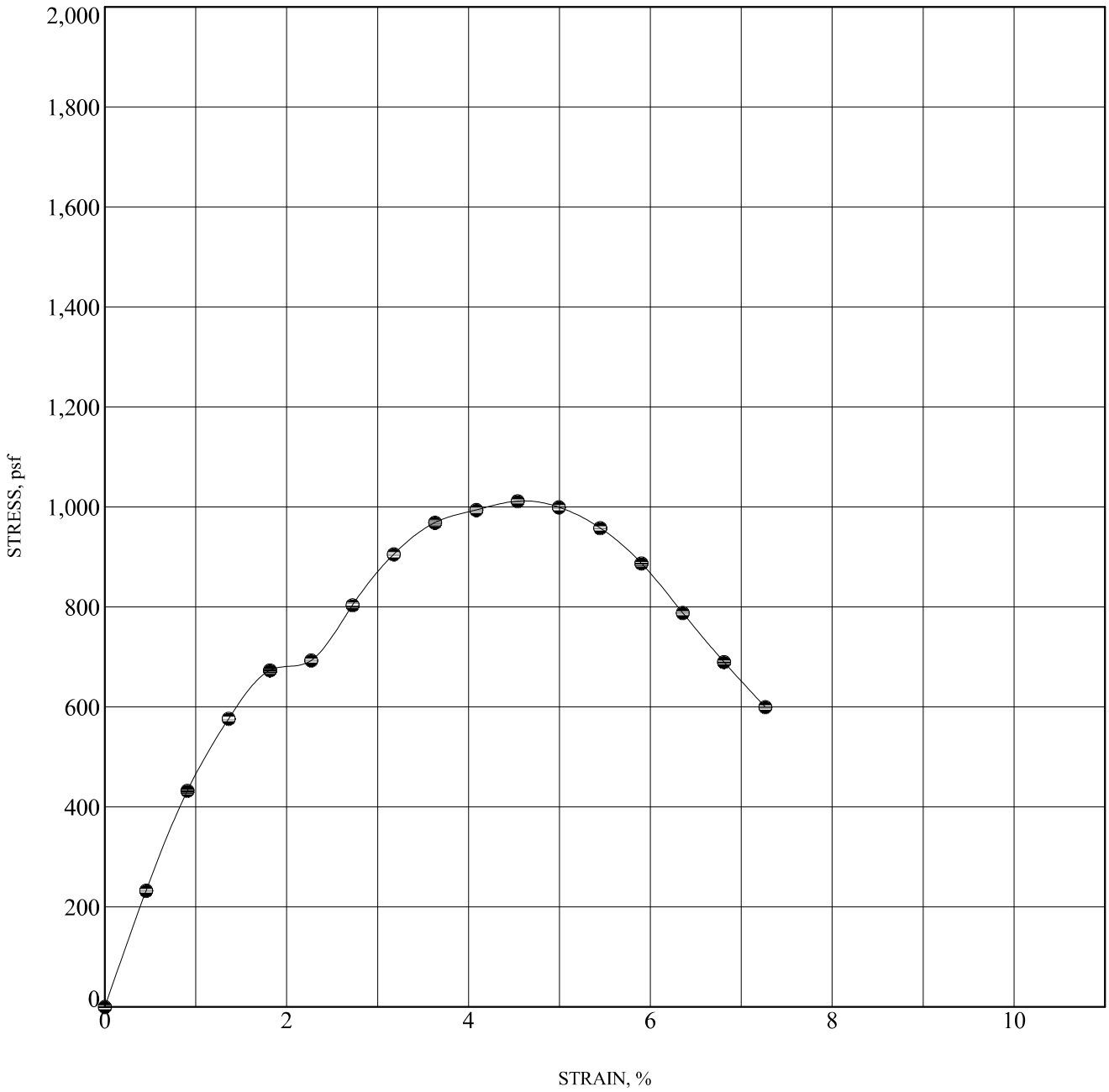
West Fargo, North Dakota

UNCONFINED COMPRESSION TEST

BRAUN SM INTERTEC

UNCONFINED 01924.GPJ BRAUN.GDT 7/21/14 14:30



Specimen Identification	Classification	γ_d	MC%	Strength	Strain
⊖ **ST-25 29.5'-31.5'**	**FAT CLAY (CH)**	**63**	**64**	**1010**	**4.5**

Braun Project B14-01924
Geotechnical Evaluation
12th Avenue NE Reconstruction
12th Avenue NE from CR19 to 45th St.
West Fargo, North Dakota

UNCONFINED COMPRESSION TEST

BRAUN SM INTERTEC

UNCONFINED 01924.GPJ BRAUN.GDT 7/21/14 14:30